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Electric Power at the Clausthal Mines

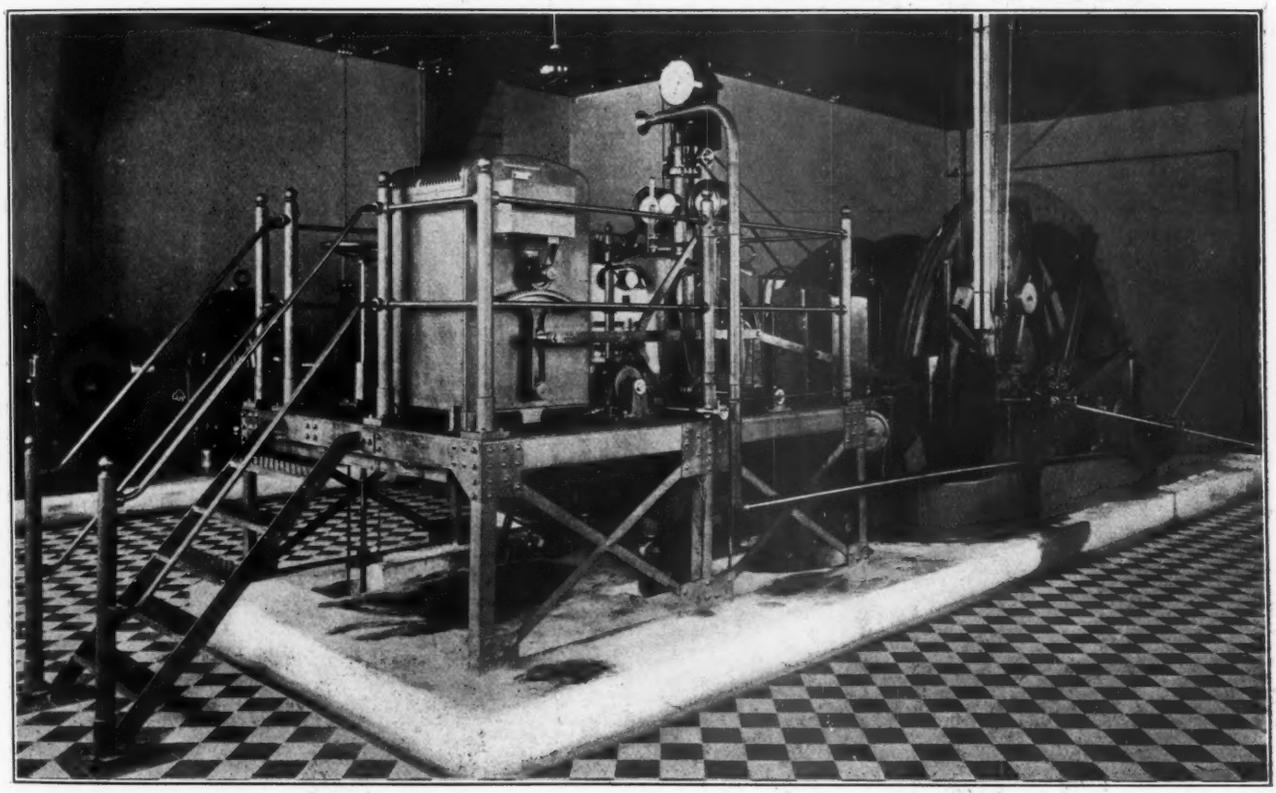
Current from Producer-gas Engine and Turbine Plants Drives the Ore-dressing Works during the Day and the Mine Hoists at Night

BY ALFRED GRADENWITZ*

Extensive electric installations of improved design have recently been completed at the mining plants belonging to the Royal Mining Department of Clausthal, Germany. The essential features of the new equipment may be taken as typical of the best German practice in the application of electric current to mining.

For the operation of the Thekla shaft continuous current at 500 volts was chosen. While alternating current would have been more suitable for the operation of motors, continuous current was preferred because it permitted storing the energy produced during intervals in operation in an accumulator battery for use during periods of extra demand. The equipment of the blind shaft includes a motor, a compressor and a hoist. The compressor is a two-stage single-cylinder compressor of the improved Meyer system, designed for belt operation which has a piston stroke of 250 mm., and at 180 r.p.m. compresses 435 cu.m. of air to a tension of six atmospheres. The consumption of energy at the compressor shaft is 46 to 47 h.p. and the motor rotates at a speed of 820 r.p.m. with 425 volts tension.

The installation at the Thekla shaft hoists a load of 750 kg. from a depth of 200 m.; the drum is 1.50 m. in diameter, and the 22-mm. rope weighs 1.74 kg. per meter. The hoist has a wrought-iron frame, upon which the drum shaft is mounted. The cylindrical drums are 1.25 m. wide each, designed to receive 230 m. of rope in one layer. The drum shaft is driven from an intermediary shaft by two pairs of spur wheels, each of which is capable of transmitting the whole of the energy with a factor of safety of six. The intermediary shaft is driven by an electric motor by means of rawhide pinions.



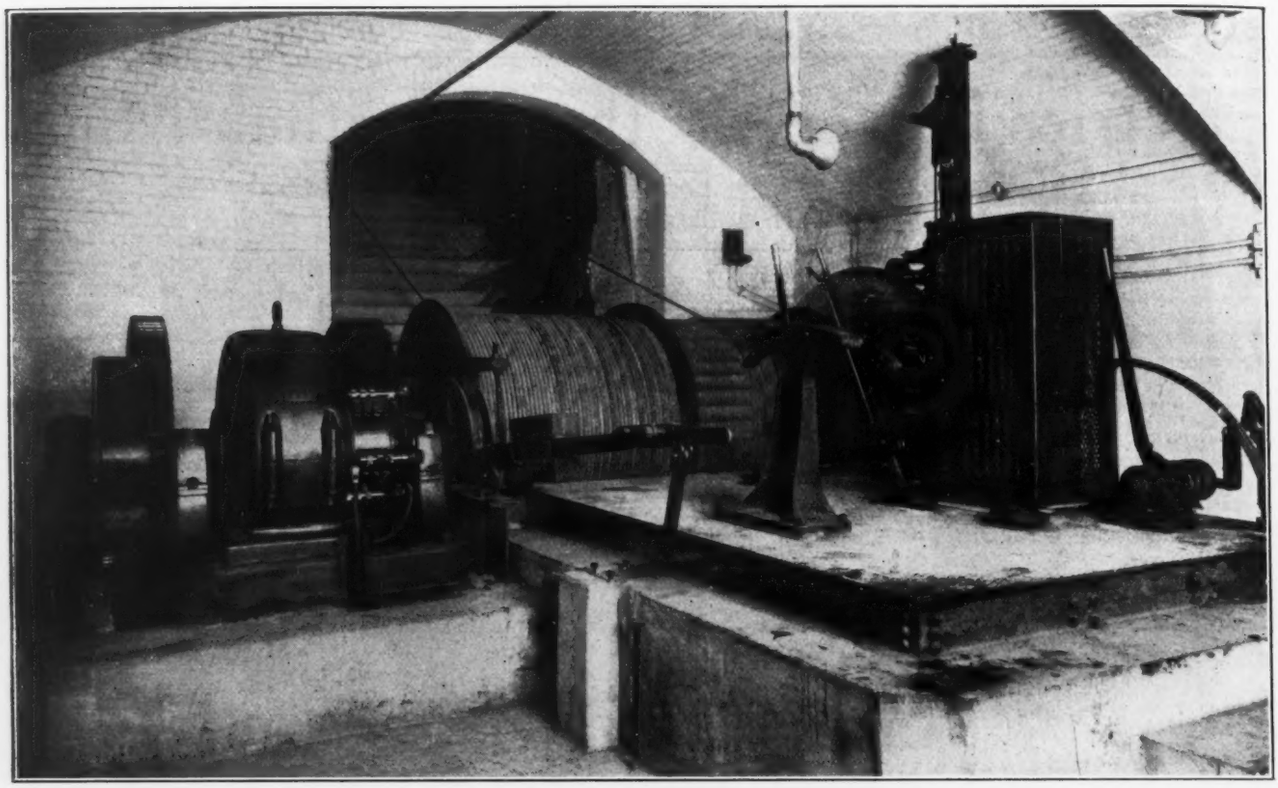
HOISTING PLANT, OTTILIAE SHAFT, CLAUSTHAL, GERMANY

Control Mechanism

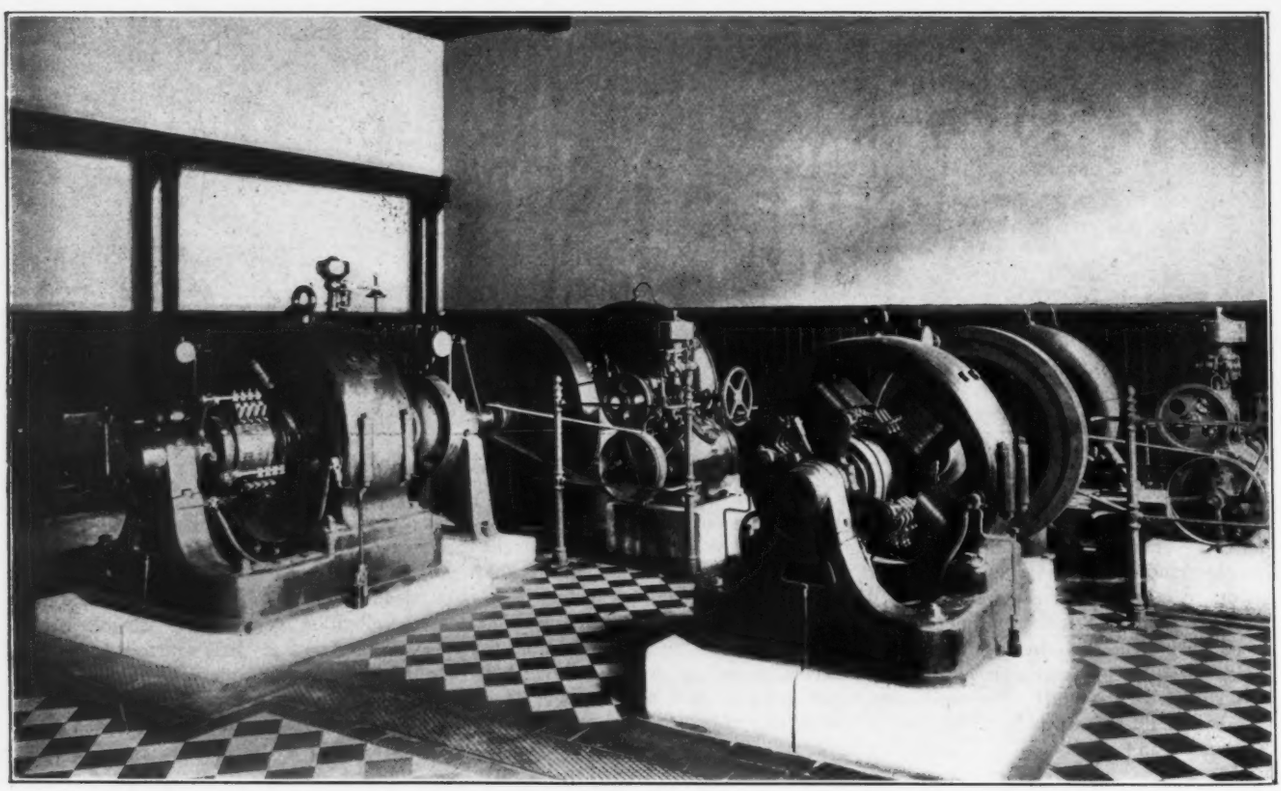
There are two brakes, the operating brake acting on the intermediary shaft. This brake is generally kept closed by a weight controlled by a lever. A safety brake, a drop-weight brake, operates on the drum shaft, and is brought into action by means of a pedal, or in case of failure in current supply by a magnet, or when all other precautions fail, by the indicator.

The motor is a single-pole continuous-current shunt motor for 425 volts tension and about 350 r.p.m.; it has a permanent load capacity of 47 h.p. and during the acceleration period it is capable of developing 90 h.p. It is controlled by means of a lever through a reversing starter patented by the Siemens-Schuckert Works. To the lever on the shaft at the lower part of the starter housing is fitted a toothed wheel segment meshing with a bevel wheel to drive a controller. To the latter are fixed metal rings graduated in different quantities, which actuate small

*Berlin, Germany.



WINDING DRUM OF THE THEKLA SHAFT, CLAUSTHAL, GERMANY



TURBINE GENERATING SETS, EINERSBERG POWER PLANT, CLAUSTHAL, GERMANY

angle levers, and which according to the position of the controlling lever will switch resistances in or out of the circuit.

The reversing starter is provided with 16 contacts and nine lever positions on both sides. In turning the lever round, the contacts effecting the reversal of the armature are immediately closed, when a braking resistance stage is inserted in parallel with the armature. The latter is connected to the circuit and the field reducing resistance is short-circuited. The motor then begins to turn slowly. By turning the lever further on, the resistance inserted in parallel will be increased during the next three stages, increasing amounts of current being supplied to the armature, while the six stages of starting resistance continue to be connected up to the armature.

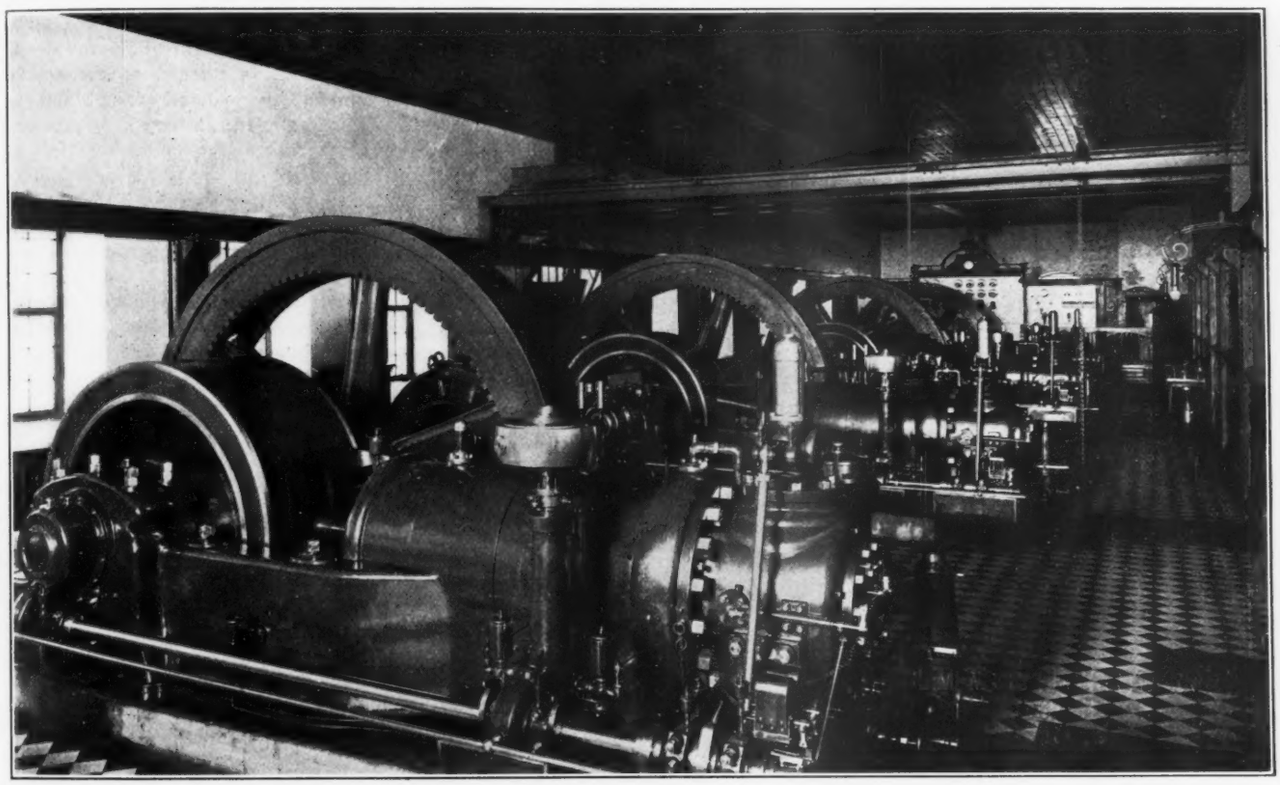
These four braking stages allow the full useful load of a winding cage to be applied without counterpoise or without using the operating brake at a very low speed, which is of the utmost importance for the rope drum. By gradually disconnecting the braking resistance, full speed is reached. A support at the operator's stand carries an ammeter and a tension meter, which indicate the load on the machine at all times.

The controlling lever is interlocked with the braking lever in such a way as to prevent the brake's being applied during operation, unless the controlling lever be shifted to the zero point.

Winding Engine of Ottiliae Shaft

The Ottiliae shaft is the main winding shaft of the Clausthal mines, through which the employees of the Rosenhof district enter and leave the workings. The winding motor, while a considerable current consumer, is far from being the only one in the power system, so that the remaining current-consuming plants had to be protected against current fluctuation. The requirements to be complied with by the winding engine were, therefore, (1) maximum safety of operation and manoeuvering capacity, (2) compensation of the variable energy output due to the winding operation, the power station being loaded uniformly corresponding to the average power consumption of the winding engine.

These requirements were met satisfactorily by using a Leonard contact and accumulator buffer battery. The winding engine is of the Koepe system, the armature of the shunt-wound motor operating the winding engine being keyed to the shaft of the driving pulley. Its field coil is applied to constant tension and derives its current from a generator driven by a special motor, and working at variable tension. This tension is altered between zero and 500 volts (the line tension) by means of a rheostat inserted in the field coil of the generator, and placed within reach of the driver. The direction of rotation is inverted by a switch fitted into the field coil. The regulating resistance serves as controller, and it communicates with the controlling lever through a lever system. The number of turns of the winding motor, and accordingly the winding speed are dependent on the tension of the generator, which in turn is determined by the position of the rheostat, or that of the controlling lever regulating the latter. Each position of the controlling lever corresponds to a given speed, the load of the motor playing an unimportant part. In the immediate vicinity of the winding engine there is placed an accumulator buffer battery made up of 242 cells, which with a normal current intensity of 180 to 136 amp. has a discharging current of 220 amp. Current fluctuations of 600 amp., occurring momentarily in operation, are within the capacity of the system.



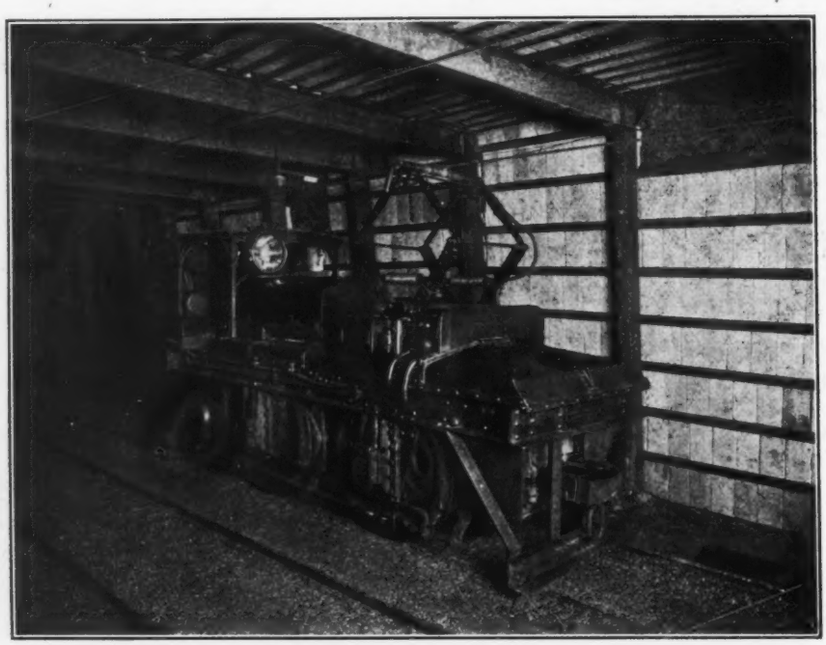
PRODUCER-GAS ENGINES, EINERSBERG POWER PLANT

Method of Equalizing Current

The current consumption in the first third of the run of the hoist is very considerable; it then drops gradually and during the last stage there is an excess of energy continuing for a short time. Since according to actual experience the battery would not be able to follow these fluctuations if connected in parallel with the current generators of the power station, the set was coupled to a buffer dynamo, intended for thus regulating the tension at the terminals of the battery, as well as the current derived from the battery during high power consumption, while returning the back current to the battery as charging current. The buffer dynamo is provided with two opposite windings,

one of which is situated with a shunt regulator directly on the line, thus producing a constant field, while the other is inserted in the wire leading to the starting motor of the set.

If the hoist and the starting motor are loaded to a small extent, or not at all, the constantly excited field coil will prevail, the tension of the buffer dynamo being increased, and the battery being charged. The higher the load on the hoist, the greater will be the second field of the buffer dynamo, the first field being gradually compensated and eventually inverted, when the polarity of the dynamo will change and the battery will be discharged. The fundamental tension of the buffer dynamo and the size of the battery are so adjusted to the line tension as to produce the effects described as soon as the current intensity of the starting motor has reached a given degree.



ELECTRIC LOCOMOTIVE IN STEEL-SUPPORTED ENTRY, CLAUSTHAL, GERMANY

The following are the chief data concerning the hoist in the Ottiliae shaft: Winding depth, 570 m.; number of trucks, 2; useful load of trucks, 750 kg.; winding speed in hoisting material, 10 m. per sec.; winding speed in hoisting men, 4 m. per sec.; winding speed in inspecting shaft, 0.1 m. per sec.; weight of winding cage, 2760 kg.; weight of rope per meter, 4.5 kg.; diameter of rope, 34 millimeters.

The hoist frame is a hollow casting on which the shaft of the Koepe drum rests in three ring-lubricated bearings. The winding drum is 3.5 m. in diameter and is constructed of wrought iron. The rope groove is lined with seasoned cross-grained oak.

Control and Safety Appliances

On the operating platform there is a support carrying a tachometer, a tachograph, a voltmeter and ammeter, as well as a manometer for the pneumatic brake. To the right and left of the rope groove there is a jaw brake. Compressed air is used in actuating one of the brakes according to the general practice in connection with electric-winding engines, this compressed air being supplied by a special compressor driven by a continuous-current motor beside the operating platform. The brake is used not only in manoeuvering, but in arresting the winding drum and in keeping it in position after the current has been cut out. The other brake, which is a drop-weight brake, is disengaged either by means of a pedal, or by the retarding device connected with the indicator. The hoist indicator has a vertical-threaded spindle with shifting nut. The motion is transmitted from the rope drum. An extremely simple safety apparatus is based on the fact that the winding speed is dependent upon the degree to which the regulating rheostat is switched into circuit, and that it is affected by the position of the controlling lever rather than by the load of the engine. In order to reduce the winding speed at any given point, curved plates are attached to the shifting nut, which, as soon as the winding cage has got to about 30 m. below the shaft mouth engage angle levers, thus shifting the controlling lever gradually and automatically into zero position. Should the cage for some reason continue its downward course, a peg fixed to the curved surfaces actuates another lever, disengaging the drop-weight brake. Before the weight has reached its lowest position, a bar attached to the lever operates an emergency switchout, so that current is cut out from the motor before the full braking effect is reached.

The cage, which is 4.22 sq.m. in free bottom surface accommodates 16 men. The plant is designed for an output of 300 cu.m. in a 10-hour shift, including the usual intervals, the time required in charging and discharging being about 54 seconds.

Ore-dressing Plant

The ore-dressing plant has an output of 360 tons in a 10-hour shift. Calcareous spar, quartz, graywacke and clay slate are found in all deposits, and spathic iron in very small quantities in the Rosenhof district. In spite of this similarity in composition, it is impossible to work the ores from the different stopes together, the structure being too different. Bins are therefore provided into which the output of each shaft is dumped according to its origin. The adjustment of the ore-dressing machines is adapted to the special character of the material treated, and the more carefully the intermediary products are kept apart the more satisfactory is the work of a plant, both qualitatively and quantitatively. A most extensive subdivision has, therefore, been carried out, both in the jigging house and in the slime-dressing plant.

Special attention was given to the choice of crushing machines, rolls being used for grains upward of 2.5 mm. in diameter, and swinging—muller grinders for grains less than 2.5 mm. thick. The dressing machinery is installed in one large room which greatly facilitates operation and supervision.

Power Station

The electric current required to operate the various motors is generated in two primary stations, the Rosenhof and the Einersberg power houses. Provision is made for carrying on ore-dressing during the day shift and hoisting during the night shift, so as to reduce the required capacity of the power station.

The Rosenhof central station contains two adjustable spiral turbines designed to receive 83 liters of water per second. One of these turbines, which has a head of 20.75 m., yields under full load 25.5 h.p., the efficiency being 77 per cent., while the other in the same case gives an output of 16.5 h.p. under an efficient head of 18.52 m. The turbines are provided with a sensitive precision regulator, which in case of sudden alterations of load amounting to 25 per cent., reduces the variation in the number of revolutions to 3 per cent. as a maximum; in case of sudden release from all load, the speed of revolution does not exceed the normal by more than 15 per cent.

The turbines operate by belt transmission two continuous-circuit dynamos at 530 volts tension. The current is supplied to the bus-bars of a switchboard installed in the central station and provided with all necessary measuring and safety apparatus, and thence through an iron-band armored lead cable to the distribution

switchboard in the engine house of the Ottiliae pit.

Four gas motors and three turbines supply power at the Einersberg central station. One unit is a horizontal-shaft high-pressure turbine designed for 83 liters of water per sec., which, with a useful head of 58 m. and full load will give 48 h.p. The second turbine is a Simplex spiral machine with a head of 50 m. and 33 liters of water per sec., yielding 170 h.p., while the third turbine, which is also a Simplex spiral machine, has been calculated for a head of 29 m. and an output of 60 h.p. with 200 liters water per second. The regulation of the three turbines is effected by means of pendulum-precision regulators. Continuous-current dynamos with shunt coils are direct-connected by a leather-band clutch to the turbines, and generate current at 530 volts.

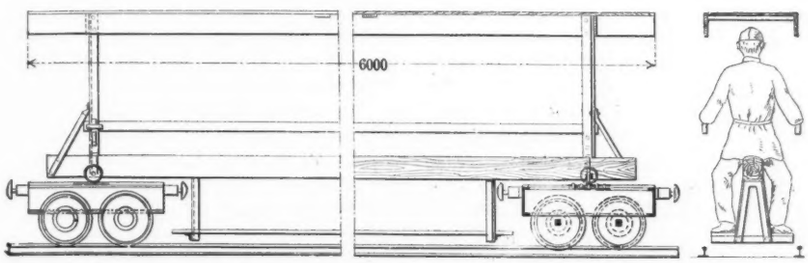
Gas-engine Plant

The gas motors, which are identical in construction, are designed for a normal output of 150 h.p. They are horizontal, single-cylinder, four-cycle motors of the Koerting system. The valve-head covers can be removed, which facilitates inspection and cleaning the cylinders. In order to avoid excessive heating of the compression compartment, the cylinder heads and the pistons are provided with arrangements for water cooling. A double ignition device removes the chance of failure to explode. The engines are started from the switchboard by means of the storage battery and the turbo-dynamos.

There are four producers with a vaporizer and scrubber each. The method of operating the gas-producers differs little from the usual practice. The plant contains two sawdust purifiers, of which only one is used at a time. Each gas generator suffices for producing gas for a normal output of 150 h.p., anthracite, coke, or a mixture of the two being used as fuel. The purified gas is led into a collecting pipe, whence it is supplied to the motors.

Each gas motor is directly coupled to a continuous-current shunt dynamo generating current at 530 volts. The current is led from the various machines through asphalted lead cables to the bus-bars of the switchboard, and thence to each of the centers of consumption of the ore-dressing plant and to the distributing switchboard of the Ottiliae pit. Two iron-band armored lead cables 310 sq.mm. in copper section lead to the switchboard situated in the motor house of the dressing plant, whence the two motors of the jig house, the elevator motor and all the lamps are fed with current. From these cables there is a branch cable of similar construction, but of smaller cross-section leading to the pump house for the pumps and the motor of the slime plant.

Special trucks are used for transporting men employed in the Rosenhof district from the Ottiliae to the Thekla shaft. The construction of these trucks is shown in the accompanying illustration. The men are seated upon a long longitudinal beam which accommodates 14 passengers.



TRUCK FOR CONVEYING MINERS TO THE WORKING FACE

Transvaal Mining Notes

Special Correspondence

It is satisfactory to state that Kafir labor is pouring in for the mines, the supply far exceeding the demand.

White Labor

Considerable disappointment has been caused by the failure of a white labor experiment at the Consolidated Main Reef. As is usual on the Rand, the tailings from the cyanide works are handled by Kafirs. In order to aid the unemployed, the manager decided to try white labor on this work, hoping that a smaller number of white men might do the work, and thereby earn more money. Instead of 52 Kafirs, 31 white men were put on. It was soon found that this number was too small, and more white men were engaged. After several days' effort the experiment was declared off, and for the present the scheme of employing white men on tailings work seems to be a failure. Mr. Shanks, the government inspector of white labor, appears to be hopeful still that in time this work will be done by white men. As the manager of the Consolidated Main Reef points out, the discharge of tailings is rather an unfortunate part of mining work to experiment with, for a delay means a stoppage of the mill, which of course is very serious. All the white men who stuck to their work, have been given work at tramming and shoveling in the mine. It is thought that they will be able to earn about $1.25 per shift at this work. Even this small pay will be welcomed by many white men on the Rand, who are now destitute.

Mining Stocks

The share market does not appear to be as hopeless as it was some months ago. Some of the better class gold shares are receiving a lot of attention. One mine has been a great favorite on the stock exchange of late, the New Unified. A couple of years ago this mine was running at a loss, and the shares stood at 3 to 4s. There has been a steady improvement, and the mine is reported to be looking well. A regular monthly profit of £3000 is being made, and as the company is now out of debt, the New Unified should become a regular dividend-payer once more. Today the shares are being sold at 20 shillings.

Starting up Idle Mines

The success of one mine seems to brighten up the surrounding district. The New Unified is in a poor section of the Rand. Two of its near neighbors, the Aurora West, and the Bantjes mines, have been idle for a long time. Rumor has it that an effort will soon be made to start up the Aurora West once more, and everyone hopes it will not be long before the Bantjes makes another start. This mine has been closed down for more than 10 years. The development on the whole was disappointing, and with the high working costs of pre-war days it was thought that a stamp-mill was not justified. Now that working costs have come down, it looks as if the Bantjes could be made to pay.

Another idle mine not far from the New Unified is the Vogelstruis Deep. This proposition would pay, but the mine is hung up for want of cash to bring it to the producing stage. The trouble is purely a financial one, but as capital seems to be frightened out of South Africa for the present, the Vogelstruis Deep will probably remain idle for some months longer.

Development work is going on at the City Deep mine, where the reef was struck in the vertical shaft a few weeks ago. Confirmatory assays show that the values of the reef are distinctly encouraging. This find at the City Deep, which is one of the "deep deep" mines of the Central Rand, is one of the most cheerful facts in connection with the Rand.

Amalgamation

The next big amalgamation scheme is the consolidation of the East Rand Proprietary mines, which is almost certain to be carried through at the annual meeting to be held in a few weeks. This is the largest scheme ever proposed on the Rand. With many people it is exceedingly unpopular, and they declare that these huge amalgamations are frightening capital away from the Rand as much as anything else.

Current Monthly Reports of Mines

Collecting Information Concerning Operations and Arranging the Data so that They May Be Easily Compared and Summarized

BY H. S. DENNY*

In every mining camp, in every mining district, and on every producing mine throughout the world, the superintendent or other responsible administrator endeavors at the end of each month to draw up an interim statement calculated to show in more or less detail those items of revenue and expenditure which go to make up the sum total of the operations for that period. The monthly period is almost universally recognized as the one best suited to the requirements of such a statement, on account of the prevailing custom of paying the heads of the various departments, and of making ordinary trade disbursements on that basis; and although there may be other interim reports, perhaps weekly or quarterly, it is almost invariably on the monthly figures that a mine's operations are gaged, either for purposes of investigation or comparison; and it finally represents the foundation upon which the annual statements with the profit and loss accounts and balance sheet are drawn.

In the preparation of reports, innumerable methods are followed according to the various views of the controllers; and illustrations can be found ranging from the most crude, up to the most elaborate methods; the former represented by a few pencil notes on one scrap of paper, and the latter by many sheets of tabulated statements, and masses of complicated figures worked out to several places of decimals. It is with the aim of arriving at some compromise between these extremes that I approach this question, a compromise which attempts to overcome at once the crudeness of the first named, and the over-elaborateness of the second; one that will in as simple a form as possible meet the demand for completeness without obscuring the main issues in a maze of confusing detail.

Objects of the Report

Primarily the objects of the report are to show on the one hand the amount of money expended, as against the amount of revenue earned on the other hand; but the bald statement of these two amounts does not throw any light on the detailed operations of which they represent the result. These operations vary so widely in character, and call into requisition so many classes of labor, grading from the unskilled workman to the profesional man, that each department calls for special classification, independently of the others.

In order to have a clear conception of the relative merit of the work done in each section it becomes necessary, therefore, to keep a set of records which should in as concise a form as possible reflect all the important features pertaining to that section. Such records should be easy of access to the general superintendent, to the head of the department, and to the subordinates of that particular head; so that at any time there may be no difficulty in arriving at the true condition of current work at any point, and as to its relative merit when compared with foregoing periods.

While I do not propose in this contribution to deal with the segregations of expenditure, I wish to make it clearly understood that the drawing of the technical report is designed to fit in as far as possible with the cost statement of each operation; and, in the study of the technical detail, therefore, each operator must be supplied with another statement of cost so that the two may be considered together.

The result of this policy is to put each operator in a position to make easily comparisons month by month as to his own progress, and to follow closely the economic effect of any alterations which he may be introducing in his daily routine. In my opinion this is an all-important factor, as it so often happens that a man is seized with a new idea, which he puts into practice frequently without being in a position to judge its precise effect on the net results.

The object of the monthly statement is therefore not only to acquaint the financial administration, such as the board of directors, with the details of the operations, but to sheet the information home in a convincing manner to the men who are actually responsible for the expenditure; and in this way to indicate plainly where expenditure is high, where improvements are being effected, and where it is possible to introduce further improvements.

Fundamental Headings

The operations of a producing gold mine may be divided into two main heads; these being first, the winning of the ore, and secondly, its treatment; and these two main divisions are further subdivided as follows: (1) Ore winning—development, stoping, timbering, shoveling, tramming, hoisting, pumping. (2) Treatment—breaking, crushing, grinding, cyaniding, inter-handling, precipitating, pumping, dumping, cleaning-up, general.

The two chief items of cost under any one of these heads are labor and materials; and in the schedules of cost to be studied by each head of department, the bulk of the figures will bear upon those two items. In addition there will be a proportion of the general accounts to be borne, such as power, head office, and sundry general expenses.

Each departmental head is first of all called upon to get the maximum efficiency from his subordinates; and he must know to a fraction the efficiency of each of the different grades of labor employed in his section. In addition to that he must divide up his operations into its main heads; in order that he may check work done by each of his men. This point will be treated of more fully elsewhere; but at this juncture, and for the purposes of illustration the responsibility of an ordinary underground shift boss may be taken as an example. Such an official is in actual charge for a given number of hours per day of the whole of a mine, or in the case of a large mine, of one particular section. During his shift it is his duty to see that work is begun punctually and that every man is in his right place, equipped with the necessary material for carrying out his day's work. He will see that a proper tally is kept of all stores issued, of holes drilled, of ore broken, of ore trammed, etc., and on the various daily tags with which he is provided, he will jot down a record of each of these operations, and at the end of his shift will hand in these records to the mine overseer. By this means a daily record is kept which gives the distribution of all labor underground, of all stores issued underground, and of all ore taken from the mine, and at what particular section of the mine.

In similar fashion, details are kept by each responsible head under each one of the important subdivisions above specified; and therefore at a glance the general superintendent can see where the heaviest items of expenditure lie at every point, both underground and at the surface.

Details of the Report

The determination of the limits to which the detail of this report should be carried is at once the crux of the whole question and a most perplexing problem. We have all heard of the gentleman who could give to five places of

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decimals the cost of general maintenance per hour, per man, per ton of rock crushed, per stamp, per month, and per ounce of gold recovered; but who didn't know what his coal bill was; and I believe that it can be taken as an axiom that one may cancel all the advantages to be gained in this direction by obscuring the main issues in too much detail.

At the same time, until a certain detail has been gone into exhaustively enough to be well understood, nobody knows its value, and the conclusion that I have come to may be tersely stated as follows: that every detail requires at one time or other the most complete investigation; but that for daily routine work only the more important and outstanding features require that close investigation. For instance, it may be thought that the lubricant used on one small isolated winding engine is being too freely used; and it may be considered advisable to place a special check on that particular point over a short period, when the question should be definitely solved for all time. To keep a record that would reflect that particular information every day would be obviously unnecessary. On the other hand, the number of tons crushed per day is an important point which must be known daily, as all sorts of other features have an important bearing on that figure.

Between these two limits there are innumerable questions affecting the daily operations of a producing mine all occupying positions of greater or less importance, and on each mine there will be some variation as to which item must be selected as having that degree of importance which calls for a daily return. In my opinion, however, there is not that variation in practice which would justify the differences that do obtain in the method of segregating the details to be found by studying reports of almost any half dozen companies, and the problem that lies before us is to endeavor to arrive at a classification which will give a general basis adaptable to almost any mine.

Basis of Calculation

The unit basis of all calculation in mining work is the ton crushed, and this is at the same time the most difficult factor to determine accurately. At every point, however, we are met by it, and it therefore behooves us to take every precaution that reasonably can be taken to keep the identity of the ton crushed as clear as possible throughout the whole routine. The second point is the original value per ton of the ore in the mine, its value in the mill, its value as a classified product, and its value as a residue; and every reasonable effort should be made to follow this question of gold recovery and gold losses to its finest point throughout.

Strangely enough, however, it is not in these two directions that the tendency to over-elaborateness exists; it is rather in the direction of figuring out the cost per ton to many places of decimals of certain subdivisions of what must be strictly regarded as general charges. An illustration of this latter point is the attempt made by certain of the Rand companies to show the cost of power on winding engines on an i.h.p. basis when the steam is drawn from a central steam-power plant.

Such a figure is impossible of attainment, and is not of the slightest use, owing to the exigencies of hoisting, even if it could be attained. It is in this last statement that the kernel of the issue lies. The figures to be produced must only be those which shall be of use to the general superintendent, and through him to his heads of departments in securing greater efficiency.

While in control of a number of producing mines in South Africa I decided to hold monthly consultations with the resident superintendents of those mines as to the progress of work generally, and the basis of discussion at each meeting was the monthly report submitted by the respective managers. When the meetings were first initiated, and discussions began on the various matters of current interest, it soon became clear that to base comparison on the figures submitted from the various mines was futile, because no two of them were drawn up in the same manner; and from this a change was gradually brought about whereby the same system was introduced at all mines of the group, when comparison became easy. During this time, the meetings gradually accepted from each mine what appeared to be good in the construction of its report, and discarded that which seemed unnecessary; and after about three years a foundation was agreed upon which it is impossible to reproduce here in full, but which may be briefly described as follows:

The Report

The various statements of the report fall naturally under two grand divisions, "Mining" and "Milling."

Under "Mining" are the following statements:

Stoping—This shows in tabulated form the details of all stoping operations for the month. In the first column the different orebodies are named and the stopes indicated by number and letter. The other columns show the number of hand or machine drills, tons, average inches, width sampled and stoped, date of last valuation, average value of width stoped and the total gold content of the ore mined.

Machine Drills, Stoping and Development—This shows the number of machines used, the number of shifts and the average number of machines used per shift.

Comparison of Grade and Tonnage of the Month and Preceding Month—This gives the tons of ore mined from each orebody and broken in development, the average stope width in inches and the average value, gold content in ounces and pennyweights, the gold called for by sampling and assay valuation, less rock sorted out, total tonnage sent to the mill, adjustment of rock in bins, total gold called for by sampling and screen assay, difference between the gold estimated in mine sampling and screen assay, gold from the mill, gold from cyanide works, gold in sands, residue and slimes, gold recovered in bar gold and the per cent. recovery and difference. Remarks at the bottom of the statement called attention to resumption of stoping, difficulties, peculiarities, etc.

Monthly Development, Footage—This shows the development on each level in the various orebodies, the direction, the number of feet, average price paid contractors, the cost per foot and totals.

Monthly Development, Tonnage—The tabular statement gives the total footage, the level, drive, orebody, detail of working place, feet driven, average assay value, stope width, backs in feet, total tons payable, and assay value.

Under "Milling" are included all operation at the surface. The statements are divided as follows:

Summary of Work for the Month—This statement shows tons of ore sent to the breakers, waste sorted, tons and per cent., tons to mill, tons in bin compared with quantity in the preceding month, tons crushed, tons of concentrates reground, number of stamps working, days of operation, and duty for stamp per 24 hours.

Gold and Silver Recovered by Amalgamation—This gives for the mill and shaking tables the screen assay value, yield per ton, amalgam recovered, mercury used, amalgam produced per ounce of mercury used, mercury lost, retorted gold, melted gold, loss in melting, per cent. fine gold in amalgam, total fine gold, fine silver, per cent. of total yield recovered, per cent. of contents recovered, average temperature of water for the month, the highest and lowest temperatures, and the quantities of coal, coke, borax and bone-ash used in retorting and smelting. In a remark the work is compared with that of the previous month.

Coal Account—This covers the coal consumed at the main boiler house, average price per ton, total cost, consumption per ton of ore crushed, cost of coal per ton of ore milled, and the amount of reduction in cost.

Cyaniding—The summary for the month shows for sand and slime treatment, the tons milled, average screen assay, gold called for, per cent. pulp treated, tons treated, number of vats discharged, average time of treatment, average assay of residues, gold in circulation at end of month, gold in circulation carried forward, bullion from mill amalgam,

bullion from shaking tables, bullion from cyanide works, actual extraction, theoretical extraction, tons reground in tube mills, cyanide consumed, lime consumed, zinc consumed, lead acetate used, sulphuric acid consumed, total dry weight of slimes, per cent. gold recovered on dry weight of slimes, and the consumption of borax, manganese dioxide, liners, coke and filter cloths. Remarks at the end of the tabular statement give additional details of operation.

Native Labor Distribution—The number of helpers debited to the working account, capital account, and development are given in shifts: mine captain and shift bosses, surveyor and sampler, machine stopers, hand stopers and drill boys, timbermen, hoist drivers and banksmen, shovelers, trammers, platelayers and skips, pumps, sorting and crushing, waste dump, mill engines and firemen, cyaniding and slimes, sundry, compound, assayers, development, smiths and boilermakers, fitters, riggers and plumbers, carpenters and painters, electrician, general maintenance, laboratory, masons, new construction and contractor's boys.

European Labor Distribution—The occupation, wages and the account to which the work is debited are given for white employees: mine captain, shift bosses, surveyor, samplers, timbermen, machine stopers, trammers, platelayers and shovelers, hand stopers, skipmen, banksmen, sorters, pumpmen, mill, engine and firemen, cyaniding and slimes, sundry, office, compound, medical attendance, assayers, smiths and boilermakers, masons, fitters, riggers and plumbers, carpenters and painters, electricians, chemical laboratory, development contractors, and electric hoist drivers.

Maintenance Work—This statement is not tabulated. It contains brief accounts of repairs, replacements and improvements.

Working Expenditures—This gives in tabular form the total cost and the cost per ton of mining, sorting, crushing and transport, milling, cyaniding, general expenses, head office, and mine development redemption.

Capital Expenditures—This contains the cost of new construction for the month.

Comparative Statement of Working Expenditure and Revenue for Three Months—The total cost and cost per ton are tabulated in a compact form. Under the expenditure are: mining, sorting and crushing, milling expenses, cyaniding expenses, general expenses, head office, mine development redemption. Under revenues are: gold from the mill and cyanide plant, and sundry revenue.

General Remarks—This is an analysis of the month's report, showing reasons for the various changes and discussing the increase or reduction of costs and revenues in the various departments.

In addition to the details given in this report, each manager makes detailed statements of the expenditure at every point.

Collecting the Data

Under "Mining" a superintendent would naturally wish to find what his values in each section are and how many tons are taken from each stope face each month. He also must know what the stoping width is and how much rock from development is taken with the mine ore to the surface. In the first sheet of the report these details are given at a glance, and in a moment he can decide whether too great a percentage of ore is being taken from the high-grade stopes or whether he is running the mine at about its average value. He can also see his average stoping width, the average mine value, and the total gold called for, and he can, according to the figures, rearrange the work to a nicety to rectify any error of judgment in the selection of the ore.

A comparison with the previous month is also given and a final comparison is made showing the relative merits of his mill valuation as against his mine assay. Any features of special importance that have occurred in connection with the actual operations of mining, are supplied in the remarks following upon the mining statement, supplied by the mine overseer.

Next in order comes the development statement, giving the footage at every point in the mine, specifying exactly where this work was done, and its nature; and this is followed with a schedule showing the tonnage developed by this work, with the assay value. The information given under these heads is all supplied (1) by the mine overseer, (2) by the mine sampler, and (3) by the mine surveyor. It was my practice to cause the mine surveyor to draw up this portion of the statement in its complete form, embodying the returns from the mine overseer and the mine sampler.

The battery manager is responsible for the information given under the division of milling. The resident engineer gives the coal return and the detail of maintenance work. The cyanide manager provides the details of treatment, and the timekeeper the labor distribution. The mine secretary draws up the schedule of expenditure and revenue, and the superintendent makes the general remarks at the conclusion of the report.

Some of the details given show at once that this report is framed to cover the conditions of a mine which uses a considerable amount of native labor, but this does not affect the principle of the distribution given.

There are, of course, a great number of matters of daily interest which are not covered by this report, but they are all of minor importance, and although they call for special investigation all the time, they do not carry much weight in summarizing the work at the end of the month. They are, in fact, the influences which lead to the results, and the results are summarized in the report.

Advantages

I have already referred to the fact that the idea of this report was originally to assist in the control of a group of mines, but I should like to point out that once the basis had been found to be a good one for a number of mines, it soon proved in practice to be just as good for the individual mine. It was certainly a great advantage to have the assistance and advice of a number of men who at the time were actually engaged in superintending big operations; and whatever is found in the report was included only because it proved of service in actual practice.

Before the heads of departments were in a position to provide their figures a system had to be devised whereby daily records were kept by almost every subordinate man on the works. Most of these records naturally amount simply to a few pencil notes on printed tags, and from these the respective heads of departments are able to compile their statements. I have the firm conviction that a knowledge of detail is absolutely essential to every executive officer on a mine, and if that detail is not kept by himself it is not known, and understood, and efficiency must suffer. I believe that it is the soundest of principles to make every responsible man cultivate the habit of keeping a record of his particular performance, and I am satisfied that the adoption of that principle facilitates the work of the general superintendent in carrying out the general policy.

Speaking from actual experience, I have often felt at a great disadvantage in not being in a position to place my finger on comparative details for a given piece of work over a given period, where I realized that something was wrong but could not definitely lay the charge in the proper quarter. I am prepared to learn that many others who have been confronted with the same difficulty have also done a considerable amount of work in its solution. I cordially invite criticism of these suggestions by those interested.

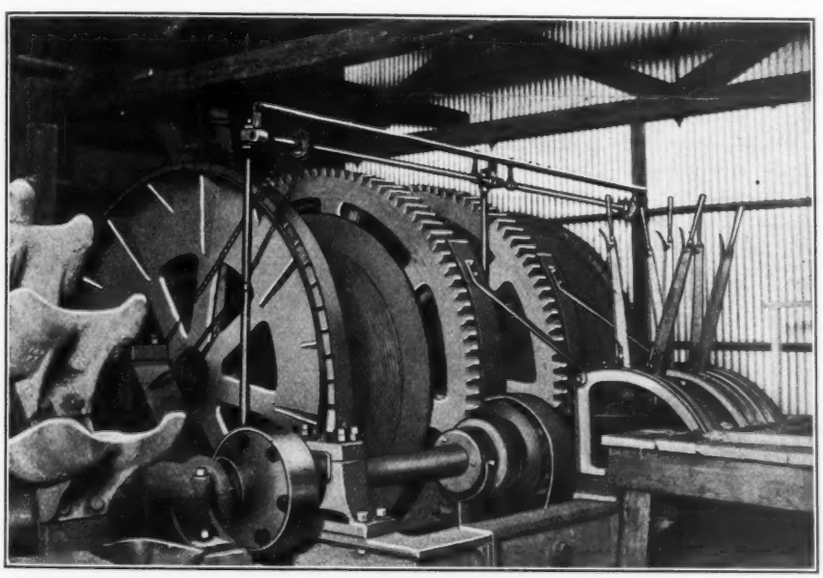
The disseminated lead ore of southeastern Missouri is mined at Bonne Terre, Flat River, Doe Run, Mine la Motte, and Fredericktown. The ore is a magnesian limestone impregnated with galena in crystalline grains from 1/16 to ½ inch in diameter; the mineralization occurs in "runs" or shoots, lying approximately horizontal, of great size. At Bonne Terre there was a stope nearly 3000 ft. long, 100 to 200 ft. wide and 25 to 60 ft. high. The orebodies vary in thickness from 5 to 100 ft., in width from 25 to 500 ft., and they have exceeded 9000 ft. in length. The Bonne Terre orebody, which has been the longest and most energetically worked, has been followed for a length of nearly 9000 feet, has produced upward of 350,000 tons of pig lead and is still far from being exhausted.

Mine Hoist Operated by Impulse Water Wheels

The Drum Is Driven by a Pinion on the Shaft of the Reversing Wheel and the Rope Is Carried 750 Feet to the Head Sheave

SPECIAL CORRESPONDENCE

A novel mine hoist to be operated by two Pelton water wheels has just been built and installed by the Lidgerwood Manufacturing Company, of New York, for the New Albany shaft of the United Mines Corporation at its gold mines on the North fork of the Tuolumne river, Tuolumne county, Cal. The hoist is installed at the bottom of a deep gulch where the water wheels, which drive it, can get the full benefit of a 400-ft. head of water, while the shaft to be operated opens on the mountain-side almost directly above with the head sheaves of the shaft 750 ft. away from the hoist.



LIDGERWOOD HOISTS OPERATED BY PELTON WATER WHEELS

The New Albany Shaft

The New Albany shaft is, at present, 750 ft. deep from the adit level where the skip dumps into the bins, but it will be sunk eventually to a depth of 3000 ft.; the dip is at an angle of 38 deg. from the vertical. The shaft has two compartments 4 ft. 2 in. square with a 3-ft. ladderway. The rails weigh 35 lb. per yard and the skips weigh 2500 lb. each and have a capacity of 2½ to 3 tons of ore. Owing to the length and weight of the unbalanced rope between the head sheaves and drums it was necessary to use a heavier skip than usual so that it would start back after dumping its load.

From the drum to the shaft head the rope is carried on supporting sheaves. The towers which support the 24-in. carrying sheaves vary in hight from 4 ft. to 24 ft. in order to provide clearance for the rope at several points. The rope travels in a curve in order to prevent the ropes from jumping out of the sheaves should a sudden pull be exerted.

Control of the Hoist

The hoist has two drums placed side by side. The drums are each 72 in. in diameter and 35 in. wide, and are grooved for 1¼-in. rope. The drums are independent of one another; each has its own pinion, clutch, gear wheel, brake, operating levers and indicator. The indicators are of the horizontal sliding type, actuated by a chain-belt connection with a sprocket wheel on the drum operating a threaded shaft along which the indicators move. The hoist and water wheels are controlled by six levers, all placed conveniently together in a rack to the right of the hoist bed plate next to the water wheels. Each lever has a thumb latch to hold it in place.

The hoist is geared. The pinion shaft extends across the bed plate immediately in front of the lever rack, bringing the pinions and clutches directly under the observation of the operator. The right end of the pinion shaft extends beyond the bed plate and carries a flange coupling to which the shaft of the water wheels is bolted. The pinions are loose upon their shaft and each drum can be brought into operation by means of a jaw clutch controlled by one of the operating levers. Two of the six levers operate the clutches, one for each drum, and two bring into action the band brakes on the drums. The other two levers give master control over the water wheels. One is for the forward action and the other for the reverse.

Pelton Wheels

The power end of the apparatus consists of two Pelton wheels mounted side by side on a single horizontal shaft. This shaft is coupled directly to the pinion shaft of the hoist. The shaft is 7 in. in diameter. The water wheels are each 8 ft. in diam. and each has a capacity of 600 h.p. under a 350-ft. head. They are operated under a head of 400 ft. by a single 12-in. needle-valve nozzle. The nozzles are arranged on opposite sides of the wheels, one at the front and the other at the back of the hoist, so that by using one or the other the motion of the hoist is reversed.

The needle valves are operated by hydraulic cylinders, taking their power from the standing head of water. The stems of the valves are connected directly to the pistons of the hydraulic cylinders. Four-way valves, on the cylinders, control the movements of the pistons. This valve gear is of the floating-lever type so that the pistons follow closely the movement of the master-control levers in the operator's rack. Connection is made between the levers and valves by means of rack shafts and levers.

Water is supplied to the wheels by a 24-in. pipe line. This terminates in a header from which the connections are taken for the two nozzles. Each wheel inlet is provided with a gate valve. The wheels have an upper housing of steel. Like the hoist they are carried on a masonry foundation. The wheel bearings are carried on cast-iron sole plates.

Installations at the Mines

The New Albany shaft with its novel and powerful hoist is part of the recent important developments made by the United Mines Corporation at the group of mines which it owns on the East belt of the Mother Lode on both sides of Tuolumne river, Cal. These improvements include a 500-ton mill and the development of a water power which operates the hoist, the machinery of the mill and an electric-lighting plant.

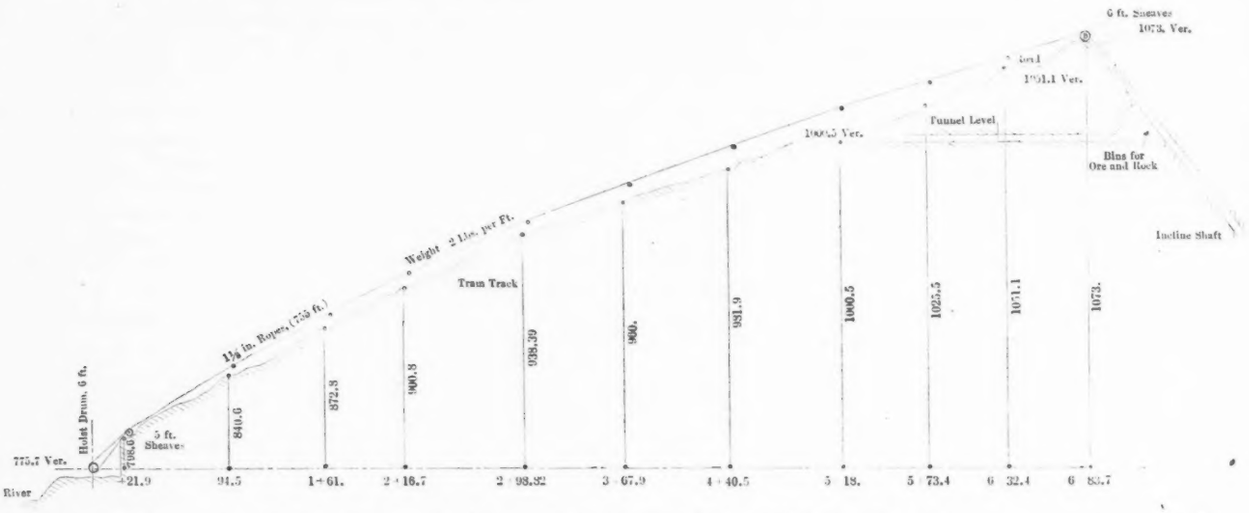
The company's water rights include the entire flow of the North fork of the

Toulumne river for power or other purposes. An intake has been built there and also about one-half mile above the mill site; a ditch has been constructed for that distance which brings the water to a point directly above the mill site, and gives a capacity of 1200 to 1500 miner's inches. About 1200 h.p. is delevoped by the water wheels.

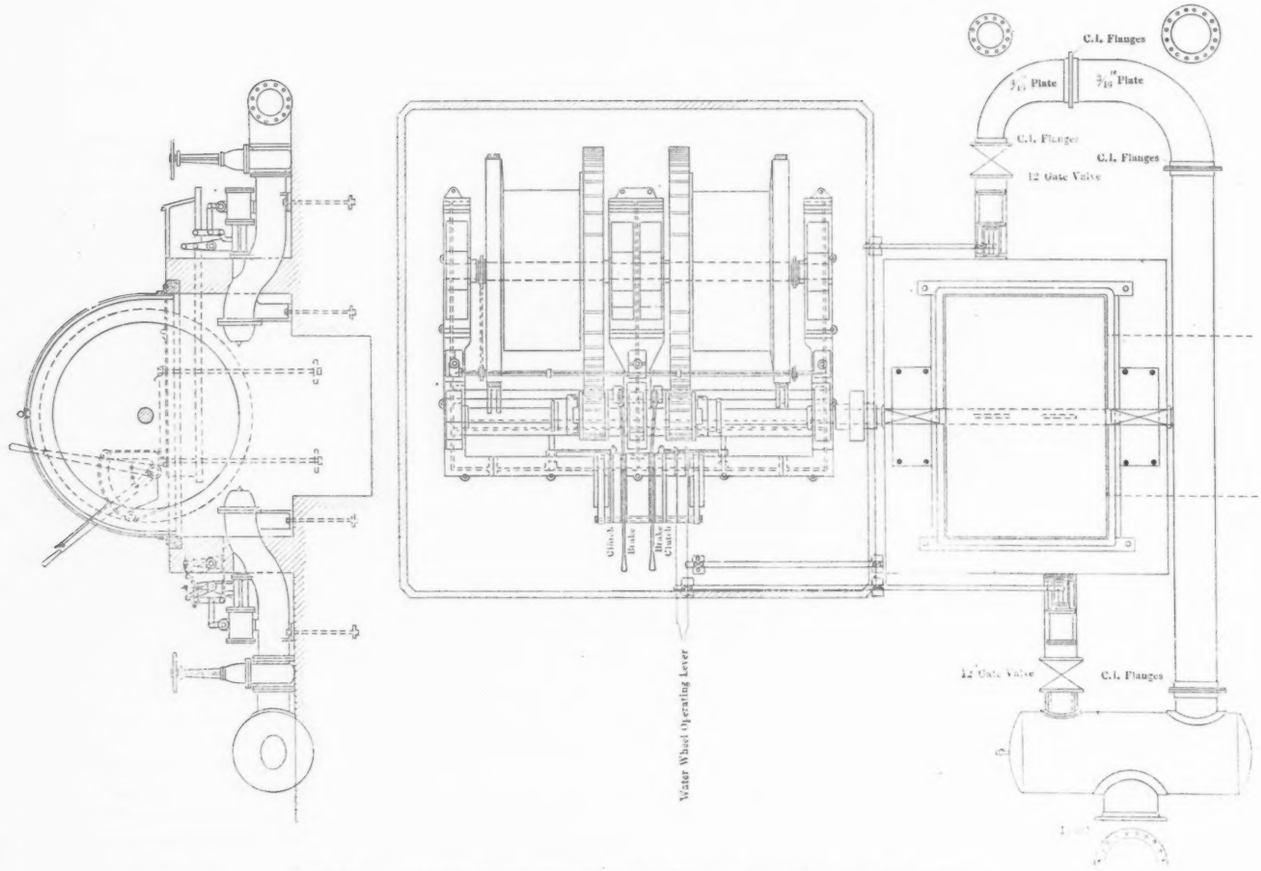
The property of the company includes a group of mines on both sides of the north fork of the Tuolumne river. The mill site is on the stream.

The site of the mill is on stream almost in the geographical center of the various groups. The New Albany shaft is directly across from the mill but at a much higher level. The ore from this shaft will be dumped down the side of the mountain to the mill. Shafts have been opened also on the North Albany and Grizzly mines. An electric tramway connects the Grizzly shaft and crusher with the mill. The Lady Washington tunnel opens from the Eureka, Dead Horse and Lady Washington group almost at the mill site, on the side of the river. Ore from here will be trammed to the mill.

The Grizzly mine has a small hoist also operated by water wheels. There will be eight water wheels in operation on the property when the mill is in running order.



PROFILE OF HILL, HOISTING ROPES AND CARRYING SHEAVES, ALBANY SHAFT



LIDGERWOOD DOUBLE-DRUM HOIST WITH PELTON REVERSIBLE WATER WHEELS

The Waste of Mineral Fuel Resources

Enormous Supplies of Natural Gas Have Already Been Lost and the Appalachian Coalfields May Be Exhausted before the Year 2000

BY I. C. WHITE*

First let us consider how we have wasted natural gas, the purest form of fuel, ideal in every respect.

At this very minute this unrivaled fuel is passing into the air within our domain from uncontrolled gas wells, from oil wells, from giant flambeaus, from leaking pipe lines and the many other methods of waste at the rate of not less than one billion cubic feet daily and probably much more.

Very few appear to realize either the great importance of this hydrocarbon fuel resource of our country, or its vast original quantity. Some of the individual wells, if we may credit the measurements, have produced this fuel at the rate of 70,000,000 cu.ft. daily, the equivalent in heating value of 70,000 bu. of coal, or nearly 12,000 bbl. of oil. In my opinion the original amount of this volatile fuel in the United States, permeating as it does every undisturbed geologic formation from the oldest to the most recent, rivaled or even exceeded in heating value, all of our wondrous stores of coal.

Suppose that it were possible for some Nero inspired by a mania of incendiarism, to apply a consuming torch to every bed of coal from the Atlantic to the Pacific, and that the entire coal supply of the Union was threatened with destruction within a very few years. There would be a united effort by the governors and legislatures of all the States in the Union to stay the progress of the conflagration; and the mighty arm of the nation would be invoked to help end the common peril to every interest. And yet this imaginary case is an *actual one* with the best and purest fuel of the country, equal probably in quantity and value for heat, light and power to all of our coal resources. No one can even approximate the extent of this waste. From personal knowledge of conditions which exist in every oil and gas field, I am sure the quantity will amount to not less than 1,000,000,000 cu.ft. daily. and it may be much more. The heating value of a billion cu.ft. of natural gas is roughly equivalent to that of 1,000,000 bu. of coal.

Extent of the Waste of Natural Gas

From one well in eastern Kentucky there poured a stream of gas for a period of 20 years without any attempt to shut it in or utilize it, the output of which, it has been figured, was worth at current prices more than $3,000,000. Practically the same conditions characterized the first 25 years of Pennsylvania's oil and gas history, and the quantity of wasted gas from thousands of oil and gas wells in western Pennsylvania is beyond computation. In my own State of West Virginia, only eight years ago, not less than 500,000,000 cu.ft. of this precious gas was daily escaping into the air from two counties alone, practically all of which was easily preventable, by a moderate expenditure for additional casing.

There can be no doubt that for every barrel of oil taken from the earth there have been wasted more than 10 times its equivalent of natural gas in either heating power, or weight, and also that much more than half of this waste could have been avoided by proper care in oil production and slight additional expenditures. In justice to the great oil-producing corporations, it must be acknowledged that they have not permitted much waste of petroleum except what has been sprayed into the air by escaping gas, and also that their handling of petroleum has been from the beginning, a model of business economy and management. The great mistake of the oil-producing interests has been in not properly apprehending the enormous fuel value of the natural gas and in not demanding legislation for its protection instead of successfully throttling and preventing it in every State of the Union except one, Indiana. When the people of that State awoke to the fact that their richest mineral possession was being rapidly wasted, they rose to the occasion, and although it was largely a case of "Locking the stable door after the horse had been stolen," they effectually prevented any further useless waste of natural gas.

For ten years I have appealed in my official capacity as State geologist to the Legislature of West Virginia to put some check upon this waste of our State's most valuable resource. Three governors have in every biennial message besought the Legislature to end this criminal destruction by appropriate legislation, but not an effective line has yet been added to the statutes, and at this very hour not less than 250,000,000, cu.ft. of gas, and possibly more than double that quantity is daily being wasted in this one State alone, 80 per cent. of which is easily and cheaply preventable.

The record in regard to solid fuel is also one to make every citizen feel distressed and humiliated, for of the total quantity of coal we have produced since mining for commercial purposes began, amounting to about 5,000,000,000 tons, at least an equal amount and possibly more has been left in abandoned mines, and irretrievably lost.

Waste of Coal

There are several causes for the enormous waste in the extraction of coal: The individual coal bed is not all pure coal, and this is especially true if it be very thick. Some of it consists of layers of sulphurous or bony coal, rich in carbon, it is true, but containing more ash, sulphur, or earthy material than first-class coal. There being no market for such coals, the operator leaves this kind of fuel unmined if it be in either the roof or bottom of his coal bed, and if it be interstratified with the pure coal, as it frequently is, he simply throws it along with other mine refuse into the gob heaps within the mine, or piles it in the hillocks of culm containing shale, clay, and other waste material at the entrance.

The quantity of this impure coal varies from 10 to 50 per cent. in nearly every coal bed, and it would probably average 25 per cent. in all the mines of the country. This material is rich in carbon, both fixed and volatile, and when utilized through the agency of producer gas, and the gas engine, will yield much more power than the same weight of the best Cardiff or Pocahontas coal when the steam engine is the agency of conversion. If in all new installations provision were made for the use of gas engines, a large portion of these impure coals could be utilized, and our purer types of fuel preserved for other purposes.

In the mining of coal, it is necessary to support the overlying strata over large areas of the mine in order that the coal may be even partially taken out; hence it is the common mining practice temporarily to utilize about 50 per cent. of the solid coal itself, in the shape of supporting pillars for the protection of roadways, air courses, working rooms, etc. On account of accidents, like falling roof rock, squeezes, creeps, crushes, mistakes in mine engineering, bad roof, and other causes, many of these huge pillars are frequently submerged and surrounded with broken rock material and thus another large portion of every coal bed, the quantity varying from 10 to 50 per

Note—Abstract of an address delivered at the Conference on the Conservation of Natural Resources, Washington, D. C., May 13.

*State geologist of West Virginia.

cent. is utterly lost, so that approximately 25 per cent. more of the nation's coal resources is wasted from these, largely preventable causes.

A third source of waste and one of unknown extent has yet to be considered. Some of the impure layers of coal may have a still larger percentage of earthy matter, and then they become partings of shale, the fossil muds and soils borne into and spread over the ancient peat bogs by the draining streams of geologic time. These partings vary in thickness from a few inches to several feet. When thin, and not exceeding 6 to 12 in., the usual mining practice is to take them out and secure the coal, but where they attain a thickness of 18 to 24 in., their removal entails too much expense for the production of bituminous coal under present commercial conditions, and hence the parting is not removed and the underlying or overlying coal as the case may be, is left in the mine usually in such a condition as to be practically irrecoverable. These parting shales often occur near the middle of the coal seam, and thus one-half of the bed will remain buried in mine rubbish with no possibility of ever securing its fuel.

Very much akin to this is another kind of waste of which we as yet cannot even approximate the extent. It is well known that in very rich coalfields several (three to ten) beds of coal may overlie each other in the same mountain, separated by from 5 to 200 ft. of rock material. It often happens that the thickest and best of the beds may underlie all the others, and hence will be the first one mined, regardless of the fact that when the overlying strata break down, some and possibly several of the higher coal beds will be so dislocated and disturbed and their areas so permeated with deadly gases from the abandoned mines below, that much of this higher coal will be lost. Of course nearly all of this loss could be prevented by mining the higher beds first.

Another deadly peril to deep-coal mining is an incident of oil and gas production. Many thousands of holes have been drilled through the coal measures to reach the productive oil and gas zones below. Very many of them have found only natural gas, and unless the well was very large, or a profitable market near at hand, the casing has been drawn and the well abandoned. It is greatly feared that in such cases, another great menace will be added to the coal-mining industry, since these abandoned oil and gas wells which penetrate the coal measures are numbered by the thousand, and no accurate public charts of them have ever been kept.

The experts of the United States Geological Survey report the quantity of fuel left unmined in the ground all the way from 40 to 70 per cent. of the total deposits.

Story of the Pittsburg Coalfields

The mining of bituminous coal, and the manufacturing industries dependent thereon originated at Pittsburg, only about a century ago, and her citizens as well as all others may learn a useful lesson by recalling the history of this beginning. The earliest settlers found there high in the steep hills which border the Monongahela river, a thick bed of splendid coal. As roadways could not be constructed to the inaccessible cliffs where the coal was first discovered, some other method of securing it was necessary.

At that time the American bison, or buffalo, roamed the vast plains of the middle West in countless millions, and these animals were so abundant even in the Pittsburg region that their skins were used for conveying the coal from the mines to the factories in the valley below, a few bushels of coal being sewed up in each hide and then rolled down the steep slopes. To our forefathers the supply of buffalo appeared inexhaustible, and yet less than a century of slaughter has practically exterminated this animal.

This passing of the buffalo illustrates in a striking way what will just as surely happen to vast areas of our fuel resources, great as they are, even within the limits of the present century, unless our people awake to what they are doing and make a determined effort to stop their destruction. The people generally have been so often told of their inexhaustible supplies of fuel, that its waste has not impressed them as a problem worthy of serious thought. They have generally believed that its exhaustion was so remote that its consideration even, concerned the present, only in an academic way.

Let us take for illustration the Appalachian coalfield, which is conceded by all to be the richest in fuel of any on the continent. It is also the most important to the welfare of the country, since it is nearest the seaboard, and contains the vast bulk of our good coking coals upon which our pre-eminence in the iron and steel industry depends. With the exception of a few narrow strips close to regions of rock disturbance or folding in our western country, no first-class coking coals have yet been discovered in the United States outside of this Appalachian basin.

It has long been recognized by all that the Pittsburg district is located in the heart of the Appalachian field where fuel of every description is most abundant, and most accessible. It is not generally known that the tonnage originating in the Pittsburg district and passing through it now exceeds that of the four greatest seaport cities of the world, London, New York, Liverpool, and Hamburg combined, so that not only Pennsylvania, but every State in the Union is interested in perpetuating as long as possible this empire of industry which our wonderful natural resources and the genius of the American people have conquered. How long can we hope to maintain this industrial supremacy in the iron and steel business of the world? Just so long as the Appalachian coalfield shall continue to furnish cheap fuel and no longer. If the wasteful methods of the past are to continue; if the flames of 35,000 coke ovens are to continue to make the sky lurid within sight of the city of Pittsburg, consuming one-third of the power and half of the value locked up in her supplies of coking coal, the present century will see the termination of this supremacy. All will admit that no portion of the Appalachian field is richer in fuel resourecs than the Pittsburg district, and if we can estimate approximately how long its fuel will last, we will have gaged in a rough way the productive life of the Appalachian field.

Probable Duration of Appalachian Coal Supply

The Pittsburg Coal Company owned on Jan. 1, 1908, according to its recent annual report, 143,000 acres of the Pittsburg coal bed, or practically one-seventh of the entire acreage of this famous seam remaining yet unmined in Pennsylvania. During the year it exhausted 2241 acres, obtaining therefrom for all purposes 18,000,000 tons of coal, or an average of 8000 tons to the acre, leaving in the ground about 5000 tons per acre of waste and unmined fuel. Hence this average of 8000 tons may be taken as a measure of the total amount of first-class fuel that will be won under present mining methods from each acre of Pittsburg coal yet remaining unmined in the Pittsburg district.

In 1906, Pennsylvania produced 109,000,000 tons of bituminous coal, 84,000,000 of which came from the five counties of Allegheny, Fayette, Greene, Washington and Westmoreland, which hold practically all of Pennsylvania's Pittsburg coal area. In 1907 Pennsylvania produced 129,000,000 tons of bituminous coal, and in the absence of exact statistics it is safe to say that at least 100,000,000 tons of this product came from the five counties in question, and not less than 95,000,000 tons of it from the Pittsburg seam.

There remains unmined in Pennsylvania only 1,100,000 acres of this great coal bed or a total available product of 8,800,000,000 tons of coal measured by the quantity (8000 tons per acre) obtained by the best mining methods of a great corporation during 1907. Eighty-eight hundred million divided by 95,000,000 yields a quotient of only 93 as the number of years this fuel in the Pittsburg seam will last if the present annual production should not be increased by a single ton. But who is there to say it will not be doubled even within the next decade?

The West Virginia productive area of this great bed is only about the same as

that of Pennsylvania, so that this contiguous region can add only a few years to the life of the Pittsburg coal production.

Gaps in the Coal Areas

It may be replied that the Allegheny series of coals which underlie the Pittsburg bed may add greatly to the fuel resources of the Pittsburg district. This is an error for the coals in the Allegheny and Conemaugh series appear to thin away and disappear as commercial propositions when they pass beneath the principal areas of the Pittsburg coal, while the active demand for coal at the seaboard will exhaust all of the productive areas of these lower and thinner coals with our present wasteful mining methods, even before the Pittsburg bed fails.

The productive coal area of the Appalachian basin has been greatly overestimated, in every one of the six great States through which it passes from Pennsylvania to Alabama. The drill of the seeker for petroleum and natural gas has taught one useful lesson, viz: that there is a wide area 50 to 75 miles in breadth deep down in the center of the Appalachian basin, that is practically barren of commercial coal. The barren area begins with the lower measures just north from Pittsburg, and embracing large portions of the former supposed coalfields of both Ohio and West Virginia, passes southwestward into Kentucky, having a breadth of 25 miles where it enters that State.

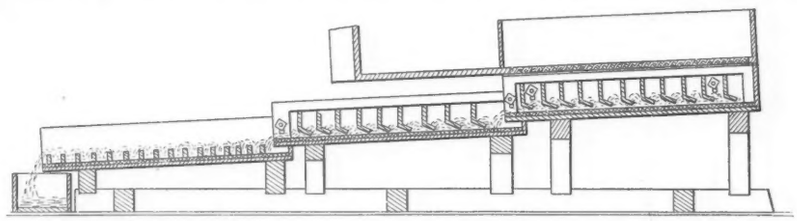
To what extent the productive area of Kentucky, Tennessee and Alabama will be affected by the southward extension of this barren belt which has already cut the former estimates of Pennsylvania, Ohio, and West Virginia in half, we do not yet know, but certain it is that all the great coal formations instead of holding productive coal entirely across this great basin as formerly supposed, are productive only as fringes 20 to 30 miles in breadth around the borders of the basin, while the great central trough is practically destitute of valuable coal. Hence with only a reasonable estimate for increased coal production, if the present wasteful mining methods continue, there will be but little coal for manufacturing purposes within 100 miles of Pittsburg at the opening of the next century, and practically no cheap fuel left in the entire Appalachian basin with which to maintain our supremacy in the iron and steel trade of the world.

The prospect is not a pleasing one to contemplate. That celebrated word picture of Lord Macaulay in which he describes a future traveler as standing on a broken arch of London Bridge, in the midst of a vast solitude, sketching the ruins of St. Paul's, may find its substantial counterpart much nearer home than we could wish. True the natural wealth of our country is so great and varied, our riches of soil, of forest, and stream are so vast if preserved, and their boundless possibilities thoroughly utilized, that we would probably have the advantage of all other nations in the struggle for existence even after our fuel resources have been exhausted; but this is no reason why we should not do everything possible to conserve them so that we may retain to a remote future the great benefits which their possession assures.

La Point Flour-Gold Separator

The new feature in the La Point gold separator for saving fine gold is that suspended riffles are used in all but the last section of the machine. The inventor has in this way tried to approximate the shape of the cavities under boulders in stream beds. This shape of the riffle produces an eddy in which the gold is supposed to have a good opportunity to settle to the bottom.

The machine is composed of three sections, each 3 ft. long, constructed of sheet steel and so arranged that it can be telescoped for convenience in transportation. In the first two sections the riffles are suspended; the bottom of these sections is covered with brussels carpet. In the third section block riffles are used. These block riffles are added to catch the coarse gold. The suspended riffles, which are made of galvanized iron, are concave, and are adjustable so that the distance between them and the bottom can be varied from 1½ in. to 2 in., according to the flow of water. The current under the riffles takes the gold down under the concave riffles and over the carpet, in contact with the nap of the carpet.



SECTION, LA POINT GOLD SEPARATOR

The clean-up is made by removing the brussels carpet, and drawing it over a roller; the nap of the carpet is thus loosened, and the gold drops off into a pan under the roller.

If used in treating gravel, the material is passed over a grizzly, shown above the separator in the accompanying illustration, so that only the fine sand enters the separator.

One of these gold separators has been installed at the Colorado School of Mines, where it is to be tested.

During 1907 the United States produced almost twice as much steel as Germany and almost four times as much as Great Britain.

Iron and Steel in France

A recent statement of the iron and steel production of France has been issued. The production of wrought iron was 747,900 tons in 1906, and 687,249 in 1907; a decrease of 60,651 tons. The forms in which the wrought iron was sold in 1907 included 576,354 tons bars and shapes; 108,252 tons sheets and plates; 2643 tons forgings.

The production of steel ingots was as follows, in metric tons:

	1906		1907	
	Tons.	Per Ct.	Tons.	Per Ct.
Acid converter.....	107,978	4.4	77,421	2.9
Basic converter....	1,494,667	61.4	1,630,511	60.9
Open-hearth.....	833,677	34.2	955,555	35.7
Crucible, etc.....	.....	.....	14,318	0.5
Total.....	2,436,322	100.0	2,677,805	100.0

The total increase last year was 241,483 tons, or 9.9 per cent. The crucible steel includes steel made in the electric furnace. The materials used in the manufacture of steel in 1907 comprised 35,000 tons of iron ore, 91,152 tons of bessemer pig iron, 1,852,506 tons of basic pig iron, 61,179 tons of manganiferous iron, 203,927 tons of forge iron, 143,621 tons of special pig iron, 35,750 tons of muck bar and 581,055 tons of old material.

The finished steel products reported in 1907 were 297,762 tons rails; 43,845 tons tires; 1,049,824 tons bars, beams, shapes, pipes, etc.; 352,042 tons sheets and plates; 33,570 tons forgings; 31,505 tons castings. In addition makers sold 452,669 tons in the form of blooms and billets, bringing the total of finished and semi-finished sales up to 2,261,217 tons.

A recent Consular report describes the discovery of a new tungsten field in India. An American mining engineer some time ago obtained a concession of part of the village of Agargaon, with a view to mining manganese. His employees, while digging in a band of mica schist rock that traverses the village, discovered a number of lumps of a heavy mineral which, on being examined by the geological survey at Calcutta, were found to consist of wolframite. The mica schist rock contains a considerable number of quartz stringers, and it is in these that the wolframite is found. The wolframite differs in appearance and constitution from the best known specimens, but it yields on analysis no less than 64.5 per cent. of tungsten trioxide.

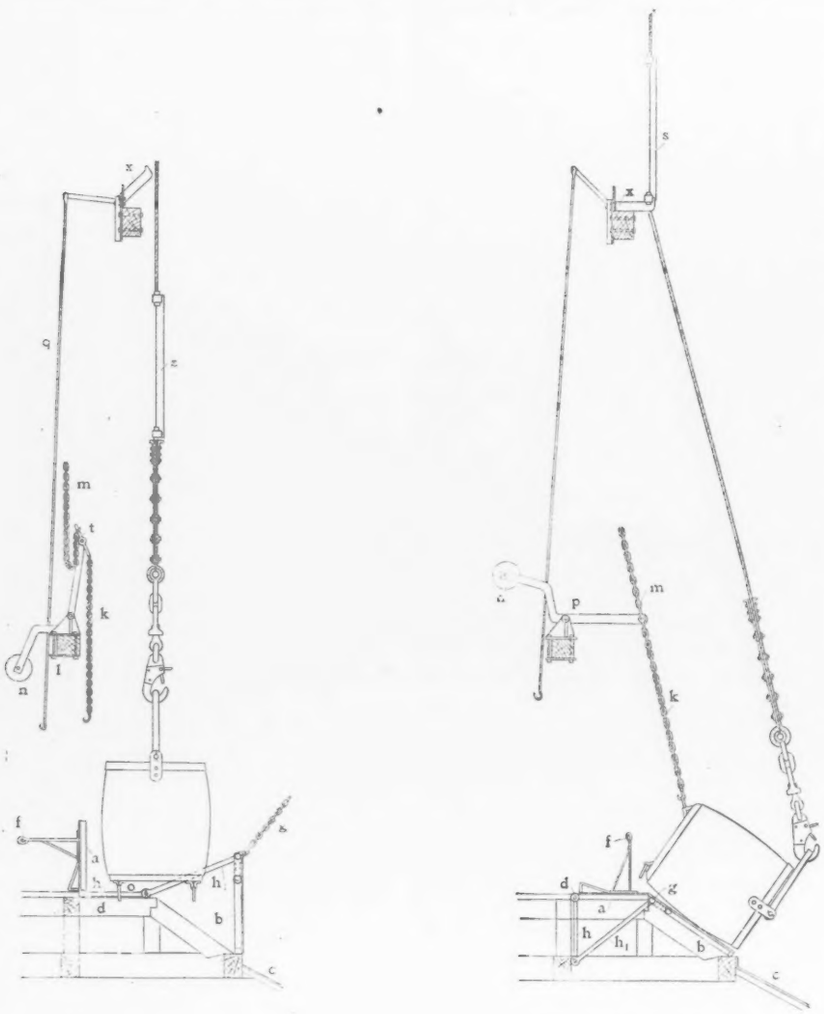
A Bucket-dumping Device

In *Glückauf* of Feb. 29, 1908, is described an ingenious arrangement for dumping the hoisting bucket at the top of a shaft at the Hermann I-II mine, in Westphalia, which was used during shaft-deepening. The opening for the bucket is closed by two trap doors, one horizontal, *a*, the other inclined, *b*. Below the inclined door is a chute *c*, over which the material from the shaft passes into cars for the dump. The doors are operated simultaneously by a system of links and levers, *h* and h_1. The lever arm *h*, is rigidly attached to the hinge *d*, of the horizontal door *a*, and at right-angles to the door. It is loosely connected, at *o*, with the long link h_1, the other end of which is hinged to the upper end of the inclined door *b*. The doors are opened and closed by the handle bar *f*, the inclined door standing vertical when fully opened. A counterweight attached to the chain *g*, facilitates the movement of the doors.

The bucket is dumped by a self-acting walking-beam device, the construction of which is shown, on a larger scale. It hinges on two axles *p p*, which are bolted to a horizontal member of the head-frame. The outer end of the walking-beam is long enough, when depressed, to reach out over the trap doors. The inner end is bent knee-shaped, and carries two iron counterweights *n n*, which normally keep the outer end of the beam elevated. The outer end of the beam has the double link *t*, from which hangs the chain *k*, for hooking to the bottom of the bucket. The chain *m*, on the upper side, prevents too great a movement of the beam.

The wooden member *l*, is placed sufficiently high above the doors, and far enough back from them, to permit the bucket to pass above and in front of it. The lever *x*, which catches and holds the rope-guide *s*, while the bucket is being lowered to its dumping position, works automatically, the weight of the rod *v*, being enough to keep its outer end normally elevated.

The whole operation can be conducted by one dumper. After the bucket has come through, he closes the doors, hooks the chain *k* into the bottom ring, pushes up the rod *q*, and gives the signal to lower. The bucket then falls over on the inclined door, and spills its contents into the chute. When the signal to hoist has been given, the chain is automatically drawn up out of the way, and the catch *x*, takes care of itself, allowing the guide to descend with the rope. The chain is then unhooked, and the doors opened by hand.



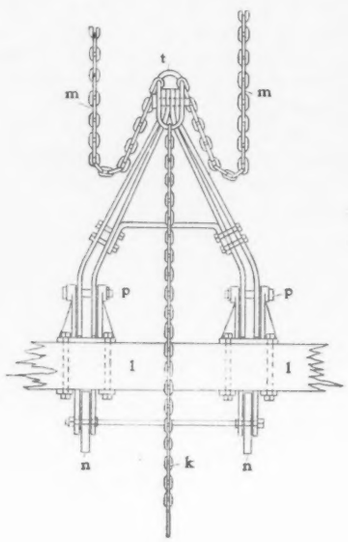
BUCKET DUMPING DEVICE

Sand Jigs vs. Tables

M. Lenicque has communicated to the Société de l'Industrie Minérale some general results of his comparative tests of sands on tables and in jigs. The two classes of machines were fed with material coming from the same screen mesh, and the relative excellence of the separation was observed on the basis of total recovery as well as on the percentage of valuable mineral in the tailings. The material used was a lead-zinc ore.

With sand 1 to 1.5 mm., the jigs were much more efficient, but with sands of 0.2 to 0.5 mm., the tables gave very good results.

M. Lenicque also gave details of a magnetic separator in which he has substituted for the usual smooth surface a surface studded with magnetic points, whereby the adhesion of the magnetic particles of ore was made more firm and the recovery was greatly improved.



Deposits of ore containing galena and anglesite occur in the valley of the Eagle river, Colo., especially at Red Cliff, at the contact between Carboniferous limestone and quartzite or porphyry. The mines of this district have produced as much as 3000 tons of lead in a year, but recently their output has been comparatively unimportant.

Dynamite may be exploded by sulphuric acid.

Allis-Chalmers Blowing Engines

Allis-Chalmers blowing engines of the long-crosshead, the compound-steeple and the compound-horizontal types in use in the various plants of the United States Steel Corporation have a total normal output of air per minute of approximately 2,000,000 cu.ft. This volume is equal to that of a tube of air having a cross-section of 1 ft. and a length of about 380 miles.

The horizontal cross-compound bessemer blowing engine shown in one of the accompanying illustrations, has a high-pressure steam cylinder 46 in. diameter and a low-pressure cylinder 88 in. diameter. Two air cylinders are each 88 in. in diameter, and the stroke is 60 in. The air cylinders are placed back of and in tandem with their respective steam cylinders. Both high- and low-pressure sides of the engine are fitted with heavy, deep ribbed cast-iron sole plates running back from and bolted to the rear and under side of the main engine frame, giving support to steam and air cylinders, intermediate and back slides. The main bearings are 24x42 in., made in four parts with wedge adjustable quarter boxes for taking up wear. The fly-wheel is 24 ft. in diameter, and weighs approximately 100,000 lb. The steam-cylinder valve gear is of the Reynolds-Corliss type. This unit is capable of delivering 30,000 cu.ft. of free air per min. against a pressure of 30 lb. per sq.in. The engine was built for the Republic Iron and Steel Company for its Youngstown, Ohio, plant.

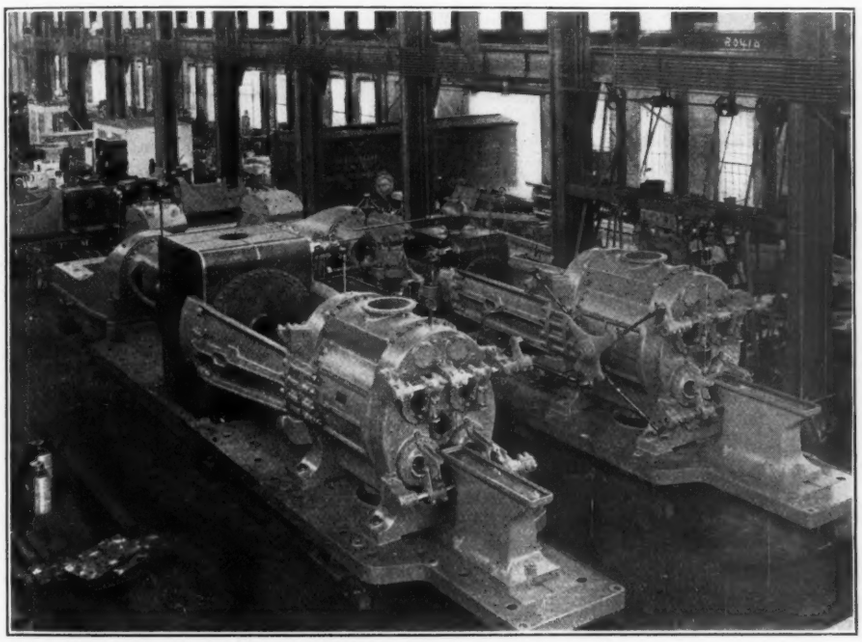
The Vertical Long Crosshead Type

The Wickwire Steel Company, on the Niagara river front, Erie county, N. Y., is about to install two high-pressure and one low-pressure Allis-Chalmers blowing engines of the standard vertical long crosshead type, adopted by most of the larger furnaces throughout the country. One of these engines is shown in an accompanying illustration.

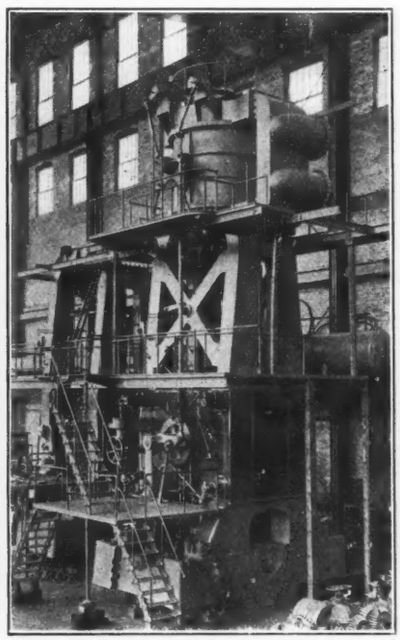
The main frames of the high-pressure engines are made of deep-ribbed castings. The slides of the high- and low-pressure engines are of the same general construction. The slides of the high-pressure units rest on their respective frames; those on the low-pressure units rest on pads provided on the low-pressure steam cylinder. The main shafts are of forged open-hearth steel turned to a diameter of 21 in. The main bearings are each 21x28 in., with loose bottom shells. The fly-wheels used are 24 ft. in diameter made in halves, and weigh approximately 60,000 lb. The cylinders for both high- and low-pressure engines are fitted with independent throttle valves so placed that they can be operated from a stage in front of each machine. The sides are fitted with individual regulators so arranged as to control the point of cut-off according to the requirements of the load, and actuated from a lay-shaft which operates the steam and air-valve gears.

The air cylinders, each 96x60 in., are fitted with independent valves two to each head, known as the Reynolds plunger-type. The discharge valves are the Reynolds cold-drawn thimble-shaped, which are automatic in opening and mechanically closed when the air piston reaches the end of its stroke and when the air pressure in the cylinder equals that of the receiver. When the valves are mechanically brought against the seats, they are held in that position by the pressure of air in the receiver, which is placed on the rear of the low-pressure engine. These engines are capable of maintaining a pressure of 150 lb. on the high-pressure engine and 40 to 50 lb. on the low-pressure with a maximum air pressure of 30 lb. per sq.in., normal air pressure from 15 to 20 pounds.

The Tonawanda Iron and Steel Company, of North Tonawanda, N. Y., is installing a new 44 and 84x60-in. crosshead blowing engine of the same type, as also is the Pennsylvania Iron and Coal Company, of Cleveland, O., which recently purchased a 44 and 84x60-in. unit also of Allis-Chalmers make. The Republic Iron and Steel Company is installing four pairs of these engines at its Pioneer plant, Thomas, Ala.



ALLIS-CHALMERS HORIZONTAL CROSS-COMPOUND BESSEMER BLOWING ENGINE



LONG-CROSSHEAD BLOWING ENGINE

Smelting Rates on Ore from Eureka, Nevada

Special Correspondence

Following is approximately the rate given by the American Smelting and Refining Company to the mines of Ruby Hill on ore for shipment to Salt Lake City, Utah: Basis of working charges for ore having an excess of iron over silica, $2.50. For each unit of silica debit 15c. For each unit of sulphur, 40c. For each unit of iron, credit 10c. Gold is paid for on the basis of $19 per oz.; silver at 95 per cent. of the assay value. Lead at 90 per cent. of the assay value. The freight charges are based on a sliding scale, ranging from $2.75 per ton up to $16, according to the value of the ore.

Limestone in West Virginia

By G. P. Grimsley*

West Virginia ranks fifth in the production of limestone flux, with the promise of a rapid development in this industry in the next few years. Limestone is used in small quantities as a flux in cupolas where the pig iron is melted for use in bessemer converters and on a large scale in the reduction of iron ores in the blast furnace. For the latter the limestone containing less than 4 or 5 per cent. silica is preferred. For each per cent. silica in the rock, 2 per cent. of lime is necessary to flux it, thereby lowering the effective work of the limestone in the furnace and requiring a greater quantity of the rock. Limestone with 2 and 3 per cent. silica may be found in a great number of localities, often near the centers of iron production, so that there is little or no profit in shipping the rock long distances to the furnaces.

In the manufacture of open-hearth steel, which is now closely crowding bessemer steel for first place in quantity produced, a limestone is required which is low in silica and phosphorus. It should be under 1 per cent. silica and not over 0.02 per cent. phosphorus. Limestones of this character are not widely distributed; in fact they represent a rather unusual type. Limestone of this degree of purity is found at Martinsburg, in the eastern part of the State.

Martinsburg is a city of about 10,000 inhabitants, the county seat of Berkeley county, and situated 75 miles west of Washington, 100 miles from Baltimore, 196 miles from Philadelphia, and 228 miles from Pittsburg. Near this place and over most of the county, as well as the adjoining county of Jefferson, there outcrops the Shenandoah limestone of Cambro-Silurian age.

This belt of limestone is highly folded over much of the area, the beds dipping at high angles. It includes a series of belts which trend N. 25 deg. E.; the different belts vary in composition, but within the same belt there is a very uniform chemical composition. Some of the belts are typical dolomites, some are magnesian limestone and others are high in silica, while certain belts are almost pure lime carbonate rocks. The high-grade limestone belts form elongated lenses and again long belts traceable for six to eight miles. They vary in width from 20 to 1000 ft. and are often bounded by the shale belt. Over much of the area there appears to be a close relation between the shale and the high-grade limestone. As followed to the west the rock becomes nearly all magnesian.

*Assistant State geologist, Morgantown, W. Va.

This rock has a shallow cover and often is at the surface. It requires careful examination to locate the high-grade rock, but its appearance, fracture and texture are so characteristic that one familiar with these belts can identify the best rock and closely approximate its composition by the eye. It breaks with irregular fracture and easily under the hammer so that while hard it is readily crushed. The composition of this rock is represented by the four analyses shown in the accompanying table:

ANALYSIS OF SHENENDOAH LIMESTONE.

	Per Ct.	Per Ct.	Per Ct.	Per Ct.
Lime carbonate..	98.00	98.50	97.60	98.80
Silica.....	0.50	0.60	0.48	0.40
Phosphorus.....	0.02	.....	.....	0.007

The rock has been drilled to a depth of 200 ft., at which depth the drill was still in limestone; the composition did not vary materially with depth. The quantity of rock is thus almost unlimited. On account of the empty coal cars returning from the sea-coast cities to the Pittsburg coal territory, a low freight rate is in effect on this stone to the Pittsburg markets.

The Standard Lime and Stone Company opened in 1892 a quarry at the south edge of the town of Martinsburg; work was prosecuted to a depth of 90 ft. The upper 25 ft. of this quarry was low-grade rock which was used as ballast, but the lower 60 to 65 ft. was high-grade, with about 0.6 per cent. silica. The rocks stand at an angle of nearly 90 deg., with a slight dip to the east. The present line of quarries of the company is about two and a half miles in length; quarries have also been opened on the other side of the town. The output is about 50,000 to 60,000 tons a month, most of which is shipped to Pittsburg.

The Martinsburg Limestone Company has a large quarry five miles west of town, opened in 1889; new quarries have been opened at Bunker Hill, eight miles south of Martinsburg. The American Lime and Stone Company, of Parkersburg, has purchased a 400-acre tract south of Martinsburg and plan to soon establish a crushing plant.

The rock is obtained by blasting out in large blocks, which are then broken with a sledge, loaded in mine cars and hauled up an incline by cable to the crushing plant. Austin or Gates rotary crushers of No. 8 size are used, with revolving screens 26 ft. long and 48 in. in diameter, and the rock crushed so as to pass a 2-inch ring. The finer material is sold for use in concrete.

There are a number of good tracts of this rock near the main line of the Baltimore & Ohio Railroad and on the Cumberland Valley division of the Pennsylvania road, which contain the belts of high-grade rock. This land now commands a price of $300 to $450 an acre, and with the growing demand for this low silica limestone for the new open-hearth steel plants, it affords an attractive investment. A complete equipment for a daily capacity of 3000 tons (60 carloads) will cost about $30,000.

The magnesian limestone or dolomite is worked at the present time at only one place, at Millville, near Harpers Ferry. Here the Standard Lime and Stone Company opened a quarry in 1901; the workings have a vertical face of 65 ft. The stone is crushed in a No. 7 Gates crusher and during the working season about 20 cars are shipped daily, mostly to Pittsburg, where it is used in lining open-hearth furnaces. The composition of this stone is as follows:

Lime carbonate, 54.72 per cent.; magnesium carbonate, 43.18; silica, 0.05; phosphorus, 0.01. There are a number of deposits of dolomite as pure as the above in the eastern limestone area, but this is the only one worked.

Ballast and Lime Quarries

The Standard Lime and Stone Company operates a ballast limestone quarry at Kearneysville, eight miles east of Martinsburg; the output is from 15 to 20 cars daily. This company also operates a lime quarry at Bakerton, northeast of this locality, where it has 12 patent draw kilns with a daily capacity of 3000 bushels; and three kilns at Engles Siding, on the Baltimore & Ohio Railroad. At the latter place the O. J. Keller Lime Company has four kilns, with a daily capacity of 1200 bushels, and a ballast quarry, with two Gates crushers, of a daily capacity of 400 cubic yards. Opposite Millville, across the Shenandoah river, is the plant of the Harpers Ferry Lime Company, consisting of three Shoop kilns with a daily capacity of 1000 bushels. All of these quarries are in the Shenandoah limestone.

The Standard Lime and Stone Company operates a ballast quarry at Keyser, using the Lower Helderberg limestone; the daily capacity is 12 cars. A ballast quarry in the Greenbrier limestone of the Lower Carboniferous, near Rowlesburg, 150 miles west of Martinsburg, is also operated by the company. The Greenbrier limestone is also crushed for ballast in the southern portion of the State, on the Chesapeake & Ohio Railroad, at Frazier, near Fort Spring. Here there is a quarry face 125 ft. high. The stone is crushed in a No. 7 Gates crusher, and 12 to 15 cars are sent out daily for use on the railroad.

About eight miles above Morgantown, on the Morgantown & Kingwood Railroad, the Deckers Creek Stone Company has a crusher using the Greenbrier limestone. The quarry face is 45 ft., and five carloads are shipped daily during the working season.

Dynamite containing less than 30 per cent. nitroglycerin cannot be detonated.

The Longwall Method of Working in England

Advantages of the System, Details of Operation and Plans for Supporting the Roof. Rate of Pay for Miners Varies with Local Conditions

BY GEORGE RAYLTON DIXON

The longwall method of working is generally considered as applicable to thin seams of coal, or to seams of moderate thickness containing bands of stone, which will serve for packing material. The advantages claimed for longwall over bord-and-pillar are: Better yield of large coal; less injury to seams above; simplicity of working; ease of ventilation; adaptability to suit local conditions. In a previous article, I dealt with the influence of the direction of the cleavage planes on the direction of advance of the face, and will now proceed to describe several schemes of working: Fig. 1 shows other points not yet considered. The direction of strike is indicated, also the direction and amount of dip. It is also plain that the seam is opened up for working all coal toward the rise of the seam.

In many instances, the winnings are through solid coal, and at other times the sides of the roads are all packed with stone. The place from which the longwall face commences must be driven wide. Fig. 2 is a section of such a place in a seam 2 ft. 10 in. thick. The width of the place is 30 ft. Because it is necessary to get the cars into the hewer at the face, and for another reason, to be given presently, the road must be made about 5 ft. 6 in. in hight. This requires that 2 ft. 8 in. of stone be taken up, or down, of such width as is required. In this case top stone is generally taken down wide enough for a plank 6-ft. long to be set up on props. The stone is built in at each side of the road; the space occupied by this gob being about twice as great as when the rock is in place. The width of the road between the packs is made about 8 ft. Fig. 3 shows such a place in plan.

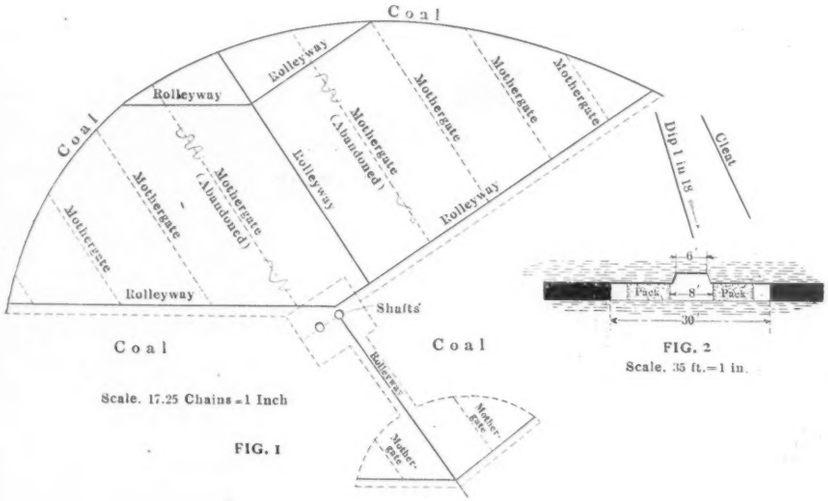
General System of Working

Hewers work in the face *A* by day; top-stone is shot down, and the packs carried forward as the place advances. In this plan the longwall face must advance to the left of the figure. The pack on the right is made continuous, while on the left-hand side, provision must be made for turning other places away. The distance apart of these places is governed by several considerations. In this case they are to be 10 yd. center to center.

Gaps are left in the packing so that the scheme here outlined can be carried out. These gaps are 8 ft. wide and on referring to Figs. 2 and 3, it will be seen that the face of the pack in the road is 11 ft. from the coal. The place we have just been describing is spoken of as "the ten-yard bord," "the ten-yard headway," or "the ten-yard crosscut," thus designating whether it is advancing across the cleat, parallel with the cleat, or in neither of these definite directions. The places which are turned away from this opening out place are called "gateways," no matter what direction they are driven.

Before a hewer can commence a gateway, about 7 or 8 ft. length of stone must be taken down, so that a turn may be laid in, off the way in the ten-yard bord, and the car can thus be brought to within a reasonable distance of the coal. The hewer then attacks a breadth of 10 yd. of coal, and as he advances, the top stone is shot down and packs built in, the same as in the 10-yd. wide winning place. If a hewer is placed in each gateway as it is won out, the face gets a stepped formation as shown in Fig. 3, each gateway thus forming a loose end for the following one. The timbering in the face of each gateway will be as shown in Figs. 4 and 5.

When the next length of top-stone is shot down, the stones will be built in at each side, great care being taken to get out all timber. If this timber is left in the packs, or in any spaces between the packs indicated by the figure, the even settlement of the roof is prevented, the packs are displaced, the immediate top-stone is broken up, and what might have been a good roof is made into a bad one.



Scale. 17.25 Chains = 1 Inch

FIG. 1

FIG. 2
Scale, .35 ft. = 1 in.

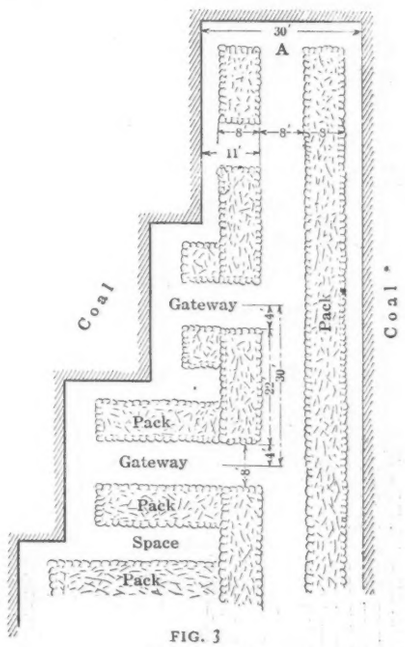


FIG. 3
Scale, .35 ft = 1 in.

GENERAL PLANS FOR DEVELOPMENT BY THE LONGWALL SYSTEM

Supporting the Roof

It should be remembered that in longwall working, timber is not set with the idea of carrying the overlying strata, but of preventing the fall of more or less small masses of rock. In the case of places driven in solid coal, if the supports are withdrawn, the roof may fall, but only to a certain hight. The stone forms a natural arch, preserving a hole of some sort in the strata. In longwall we must use timber to keep the stone above in place till the mangling action of the overburden, caused by the extraction of the coal, ceases. Then the side pressure will have reasserted itself, and after awhile, it often happens that all timber can safely be removed from the gateways back from the face, without the least danger of any stone falling. There is no doubt that this crushing action rips the coal at the face, and reduces the thickness of the seam.

As the goaf gets longer, the overburden begins to settle on the packs. The timber in the gateways is broken and has to be frequently renewed, until at last, there is a proper break. This break will test the efficiency of the pack work, and puts the working places on a new basis. The overstrata has now secured relief. The pressure will follow the working faces, and will be easy to control if studied intelligently. The miners in the gateways will now get the benefit of the weight of the work above in working the coal, although it will be evident that the man in the face of the 10 yd. winning will be rather out of its influence.

13 gateways constitute a district, which latter includes a "mothergate," and six gateways on each side. Instead of the gateways being continued indefinitely, they were cut off every 50 yd. or so by a road called a cross-heading. It is evident that a second ripping must be made in

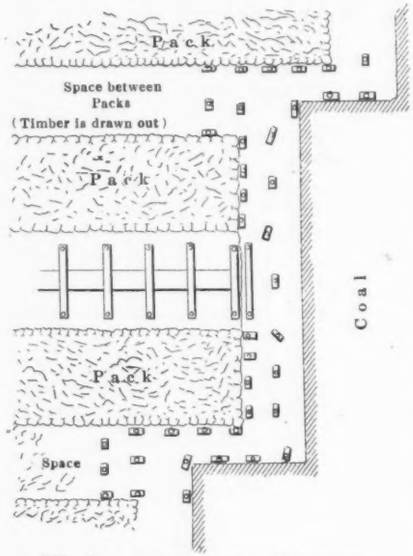


FIG. 4. Plan of the Face of a Gateway. Scale, 15 ft. = 1 in.

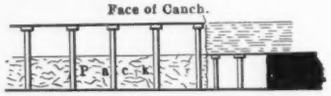


FIG. 5. LONGITUDINAL SECTION OF A GATEWAY

as pass-byes, when several drivers are employed.

On referring back to Fig. 1, it will be seen that the mothergates on which the haulage is generally of a secondary character are cut off by main rolleyways, so that the coal may be cheaply transported to the shaft, and so that the length of roads to be kept in repair is kept as low as possible. The length of mothergates usually does not exceed 600 yards.

In Fig. 1 the face is shown as extending in an unbroken line, and nothing could be better than this. However, the question of regulating the shape of the face is most important, so I will discuss some of the methods adopted. On referring to Fig. 6, it will be seen that the mothergate of each district leads. The cross-headings, cutting off the gateways in a natural and easy way. When a gateway is driven up to within 5 yd. of the center line of the cross-heading that will cut it off, the hewer goes around and works in the cross-heading. When he has won out his breadth of coal, he continues his gateway, leaving the cross-heading for the man in the following gateway, who in turn drives it over to allow his gateway to proceed. As each new gateway holes into the heading, it becomes the traveling road, and if there is a heavy fall in the face, it may be used as an airway. Old gateways are allowed to close, or serve for rooms in which to stow the stone from the second ripping on mothergates. If a line, dotted in Fig. 6, be drawn, joining the faces of the mothergates, it will be apparent that

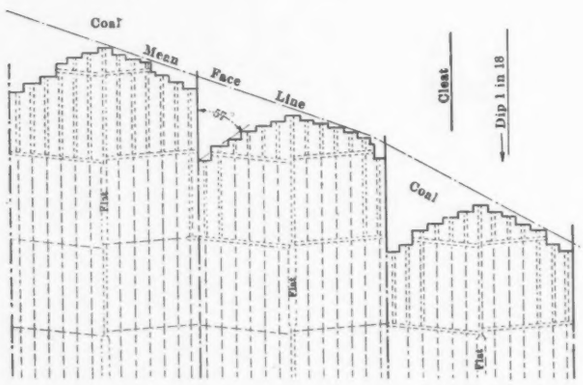


FIG. 6. SHOWING THREE DISTRICTS. MOTHERGATES ARE LEADING

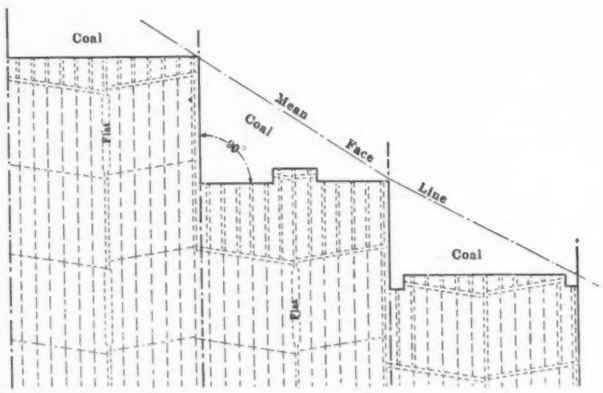


FIG. 7. SHOWING THREE DISTRICTS, EACH OF WHICH HAS A STRAIGHT FACE

The roof will come down until the gateways are only 4 ft. high, or less, and the packs will have been squeezed until instead of being 8 ft. apart they will probably be only 5 ft. apart. Owing to this and to the longer distance, the difficulty of getting the coal out of each gateway becomes greater.

Handling the Coal

A longwall face is divided into districts. One of the gateways is selected as a main road, and is called a "mothergate"; about the mothergate, as it must be kept of sufficient hight and width to take out all the coal from the 13 gateways. The putter's flat is made on the mothergate. A new flat is made every other pillar. The term pillar used here means the distance between cross-headings. The flat is often kept supplied from the main haulage system, by driving in sets on the mothergate with strong cobs. In other cases the main haulage system is carried into each mothergate. When horses are used, the old putter's flats on the mothergate serve the coal is liable to be severely crushed in this method, and much small coal made.

Another System of Development

Fig. 7 shows another method. The face of each district is kept on a straight line., When the mothergate is nearly up for the new cross-headings, the men are put in double so that it can be driven in advance. On joining the most advanced portion of each district, it is evident that again a considerable part of the coal will be crushed. The shape of the coal projecting

back into the goaf is better, however, for resisting pressure. Fig. 8 shows a method by which the actual line of face is kept coincident with the mean line of face. On referring further to Fig. 9, which shows but one district on an enlarged scale, it will be seen that this entails considerable trouble.

On the right side, the cross-headings advance from the mothergate to the barrier gateway, or the last gateway of the district. On the left side, however, the barrier gateway, which in this case is the first gateway of the district, is up its distance for a new cross-heading first. The gateways are numbered from the mothergate to the barrier gateway at each side. When the hewer in No. 6 gateway to the left gets up the distance for a new cross-heading, a gap is left in the packing, the course of the cross-heading is put on with a miner's dial, and the top stone is shot down as far as the coal. When the hewer in No. 5 gateway works his place up to within about 5 yd. of the center line of the new heading, he goes around into No. 6 gateway and drives the heading over, the coal going down No. 6. The hewer in No. 4 gateway follows in similar fashion. When he goes around into the cross-heading, his coal also comes out by the No. 6 gateway. If this plan were followed out, we would finally have the coal from No. 1 out his gateway again. He then drives on his new gateway, his coal coming out by No. 3. Similarly the hewer in No. 1 drives the cross-heading from No. 2 to win out No. 1 again, the coal from this new gateway also coming out by No. 3. When the mothergate gets up the proper distance, the center marks of the cross-heading are sighted through, and the top canch shot through, thus allowing the coal to come onto the mothergate that way,

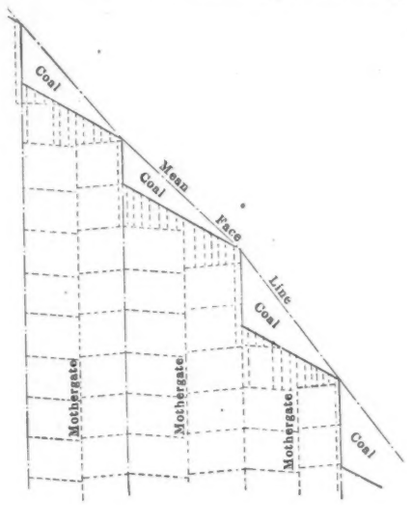


FIG. 10. SHOWING MEAN FACE LINE

trict were advancing from the mothergate. This makes the cost of conveying all the coal of the district more than it would have been under the latter circumstances. On the right side there are generally two cross-headings in use. The putters are thus separated and do not get in each other's way.

There are also two cross-headings in use on the left side, but all the coal comes out of the low or old cross-heading onto the mothergate. The putting of the coal is not, therefore, so easily carried out. It will be seen that set against the advantages derived from keeping the whole length of face on a line, there are many disadvantages. As a matter of fact, the percentage of large coal obtained in some seams is greatly increased by adopting such a plan as has been described. If, however, the several districts are allowed to lag one behind the other, as can frequently be seen, all the trouble and expense is of no avail. This will readily be appreciated on reference to Fig. 10.

Longwall Applicable to Dirty Seams

Longwall can be applied to seams containing bands of stone, or covered by a short-grained stone which falls away as the coal is worked out. Under these circumstances there is often plenty of hight

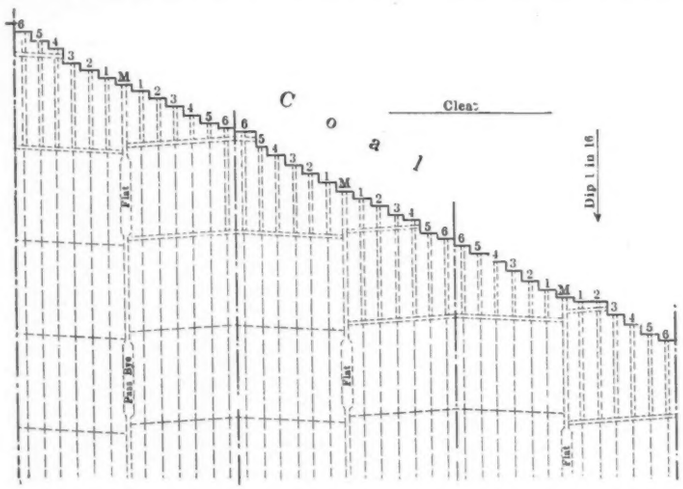


FIG. 8. SHOWING HOW A CONTINUOUS FACE MAY BE KEPT

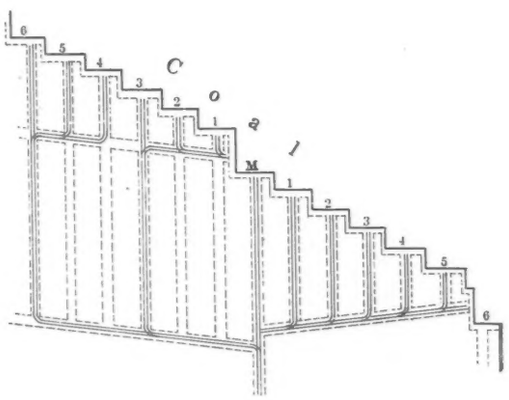


FIG. 9. SHOWING HOW COALS ARE LED FROM GATEWAYS TO FLAT

gateway going along the new cross-heading to No. 6, then down No. 6 and back to the mothergate. We would, in fact, have the coal traveling around the three sides of a rectangle instead of along one side. This would be absurd and is not done. The hewer in No. 3 gateway continues on, and the top canch between No. 4 and No. 3 does not follow the coal, but is shot through when the coal of No. 3 is far enough past to allow of this being done. The coal from No. 3 gateway continues to come out by the old No. 3.

When the hewer in No. 2 is about up his distance, he goes around to No. 3, and by driving the cross-heading on, wins and the old cross-heading is laid off. Comparing the left side of the district with the right side, it is thus evident that No. 6 and No. 3 gateways are a long time in use. The cross-headings are also kept a long time in use. Consequently extra hight must be made in these roads, which incurs an extra cost.

Again, comparing the two sides of the district, the average distance the coal has to be hauled to the putter's flat is farther, and, therefore, the cost on that score is greater. The distance of the putter's flat from the face of the mothergate is often greater than would be necessary if the cross-headings on both sides of the district were advancing from the mothergate. This makes the cost of conveying all the coal of the district more than it would have been under the latter circumstances. On the right side there are generally two cross-headings in use. The putters are thus separated and do not get in each other's way.

There are also two cross-headings in use on the left side, but all the coal comes out of the low or old cross-heading onto the mothergate. The putting of the coal is not, therefore, so easily carried out. It will be seen that set against the advantages derived from keeping the whole length of face on a line, there are many disadvantages. As a matter of fact, the percentage of large coal obtained in some seams is greatly increased by adopting such a plan as has been described. If, however, the several districts are allowed to lag one behind the other, as can frequently be seen, all the trouble and expense is of no avail. This will readily be appreciated on reference to Fig. 10.

Longwall Applicable to Dirty Seams

Longwall can be applied to seams containing bands of stone, or covered by a short-grained stone which falls away as the coal is worked out. Under these circumstances there is often plenty of hight for the coal cars to travel along the face. The miner can, therefore, attack a wider breadth of coal, as he does not need to cast the coal to where the hight for the car is made in the gateway.

If the seam is high, and of clean coal, the car can be taken along the face, thus saving casting, but it is not good policy spacing the gateways wider apart. We must get sufficient material to pack the sides of the gate roads at least, and the hight to which these gate roads can be ripped is limited. Moreover, the nearer the gateways are together the quicker the face will advance, and from this point of view, gateways are often put in nearer to-

gether, when there is an abnormal thickening of the seam, so that the face is kept in good shape.

The hewers are paid in longwall places on a variable scale, depending on the hight of the coal. The table following gives one of these scales, but it must be understood, that even in the same seam, there is a considerable difference in the prices paid at the different collieries. At one colliery there is often a line of division, on the two sides of which different scales apply. The owners or men at any colliery can appeal to the county joint committee for a readjustment of prices.

LONGWALL TONNAGE PRICES.

At and above 3 ft. 4 in.—1 s. 6 d. per ton,
At and above 3 ft. 2 in.—1 s. 7 d. per ton,
At and above 3 ft. 0 in.—1 s. 8 d. per ton,
And so on, 1 d. per ton increase for every 2 in. the seam decreases in hight.

In whole places 2d. per ton more than the above prices are paid. The whole price shall be paid on gateways next to the solid coal. Whole prices are also paid in every gateway as it is turned away, until it is more than 25 yards from the solid coal, when the longwall prices take effect. When the seam is below 3 ft. in thickness, the hewer will not be required to kirve. The prices quoted are net prices, and are subject to the country rises and falls. At present 47½ per cent. is added.

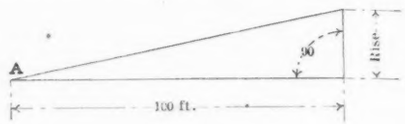
The work of making hight in the gateways and stowing the stone is done by shift work at some collieries. At other mines, there is a scale of 1⅛d., 1¼d., 1½d., or some such price, per inch per yard. The width of stone taken down is generally sufficient to allow the setting of a plank 6 ft. long. Thus a canch 30 in. thick at 1½d. per inch per yard would be 3s. 9d. per lineal yard. Other collieries let the canch work in each district every quarter, awarding the contract to the lowest bidder.

The prices for putting are generally as follows: For the first 130 yd., 11d. per score, and 1d. per score for every additional 30 yd. The distance for the fortnight to be an average obtained by measuring the distance of the two nearest places and the two farthest places from the center of the flat. Longwall coal-cutting machines of both the disc and the bar types are used to a great extent, and also face conveyers.

Designing Inclined Haulage Plants*

By Charles Kuderer†

The most important problem to consider in designing a haulage system for a slope or inclined plane is the calculation of the forces existing on the different degrees of slope. The following table, which has been compiled with much care, is designed to save the many tiresome calculations which would otherwise



be necessary. The table has been prepared to answer for all grades up to 74 per cent., and the stress in the rope for each ton, and for a varying friction constant, can be readily ascertained by reference to the proper line and column in the table.

The friction coefficients have been carefully deduced after a consideration of the kind of haulage roads that exist; the friction on a road with sharp curves is nearly double what it would be in case of a straight inclined plane. The total pull in the cable can be readily obtained by multiplying the stress given by the number of tons to be hauled.

Priming in boilers may be caused by carrying the water line too high, irregular firing, or the sudden opening of the stop-valve.

*Copyrighted by Charles Kuderer.
†Engineer, Avonmore, Penn.

FORCES ON INCLINED PLANES.

% of Grade Rise Ft. per 100 Ft.	Angle A.	Sine.	Cosine.	Perpendicular Pressure on Plane per ton of 2000 lb.	Stress in Rope per ton 2000 lb. Friction 1/40	Stress in Rope per ton 2,000 lb. Friction 1/32	Stress in Rope per ton 2000 lb. Friction 1/25	Per Cent. of Grade Rise, ft. per 100 ft.	Angle A.	Sine.	Cosine.	Perpendicular Pressure on Plane per ton of 2000 lb.	Stress in Rope per ton 2000 lb. Friction 1/40	Stress in Rope per ton 2000 lb. Friction 1/32	Stress in Rope per ton 2000 lb. Friction 1/25
1	0°35′	.0101	.9999	1999.8	70	82	100	38	20°49′	.3553	.9347	1869.4	756	768	784
2	1° 9′	.0200	.9997	1999.4	90	102	120	39	21°19′	.3635	.9315	1863.0	773	785	801
3	1°44′	.0302	.9995	1999.0	110	122	140	40	21°49′	.3716	.9283	1856.6	789	801	817
4	2°18′	.0401	.9991	1998.2	130	142	160	41	22°18′	.3794	.9252	1850.4	805	816	832
5	2°52′	.0500	.9987	1997.4	150	162	179	42	22°47′	.3872	.9219	1843.8	820	832	848
6	3°27′	.0601	.9981	1996.2	170	182	199	43	23°17′	.3952	.9185	1837.0	836	848	864
7	4° 1′	.0700	.9975	1995.0	189	202	219	44	23°45′	.4027	.9153	1830.6	851	863	879
8	4°35′	.0799	.9968	1993.6	206	221	238	45	24°14′	.4104	.9118	1823.6	866	878	894
9	5° 9′	.0897	.9959	1991.8	228	241	258	46	24°43′	.4181	.9083	1816.6	882	894	913
10	5°43′	.0996	.9950	1990.0	248	261	278	47	25°11′	.4255	.9049	1809.8	897	909	925
11	6°17′	.1094	.9939	1987.8	267	280	297	48	25°39′	.4328	.9014	1802.8	911	923	939
12	6°51′	.1192	.9928	1985.6	287	300	317	49	26°07′	.4402	.8978	1795.6	926	938	954
13	7°25′	.1290	.9916	1983.2	307	319	337	50	26°34′	.4472	.8944	1788.8	940	952	962
14	7°59′	.1388	.9903	1980.6	326	338	356	51	27° 2′	.4545	.8907	1781.4	955	967	981
15	8°32′	.1483	.9889	1977.8	345	357	375	52	27°29′	.4614	.8871	1774.2	968	980	994
16	9° 6′	.1581	.9874	1974.8	365	377	395	53	27°56′	.4684	.8834	1766.8	980	992	1008
17	9°39′	.1676	.9858	1971.6	384	396	414	54	28°23′	.4573	.8797	1759.4	994	1005	1022
18	10°13′	.1773	.9841	1968.2	403	415	433	55	28°49′	.4820	.8761	1752.2	1008	1018	1036
19	10°46′	.1868	.9823	1964.6	422	434	452	56	29°15′	.4886	.8724	1744.8	1021	1032	1049
20	11°19′	.1962	.9805	1961.0	441	453	471	57	29°41′	.4952	.8687	1737.4	1034	1045	1061
21	11°52′	.2056	.9786	1957.2	461	472	490	58	30° 7′	.5017	.8650	1730.0	1047	1058	1071
22	12°25′	.2150	.9766	1953.2	473	491	509	59	30°33′	.5082	.8611	1722.2	1060	1071	1087
23	12°58′	.2243	.9745	1949.0	497	509	525	60	30°58′	.5145	.8574	1714.8	1073	1084	1100
24	13°30′	.2334	.9723	1944.6	514	527	543	61	31°23′	.5207	.8537	1707.4	1085	1096	1112
25	14° 3′	.2427	.9700	1940.0	533	540	562	62	31°48′	.5268	.8498	1699.6	1097	1107	1124
26	14°35′	.2517	.9677	1935.4	551	563	580	63	32°13′	.5331	.8460	1692.0	1110	1120	1137
27	15° 7′	.2607	.9653	1930.6	569	580	598	64	32°38′	.5392	.8421	1684.2	1122	1132	1149
28	15°39′	.2697	.9629	1925.8	587	599	616	65	33° 2′	.5451	.8383	1676.6	1134	1144	1161
29	16°11′	.2787	.9603	1920.6	605	617	634	66	33°26′	.5509	.8345	1669.0	1145	1154	1171
30	16°42′	.2873	.9578	1915.6	622	630	651	67	33°50′	.5567	.8306	1661.2	1159	1167	1183
31	17°14′	.2962	.9551	1910.2	639	650	669	68	34°13′	.5623	.8269	1653.8	1168	1178	1194
32	17°45′	.3048	.9523	1904.6	656	660	686	69	34°37′	.5680	.8229	1645.8	1180	1190	1206
33	18°16′	.3134	.9496	1899.2	673	686	703	70	35° 0′	.5735	.8191	1638.2	1191	1200	1217
34	18°47′	.3219	.9467	1893.4	690	703	720	71	35°23′	.5790	.8152	1630.4	1202	1211	1227
35	19°18′	.3305	.9438	1887.6	708	721	738	72	35°46′	.5844	.8114	1622.8	1211	1221	1238
36	19°48′	.3387	.9408	1881.6	724	737	754	73	36°08′	.5896	.8076	1615.2	1222	1231	1249
37	20°19′	.3472	.9377	1875.4	741	754	771	74	36°31′	.5950	.8036	1607.2	1233	1243	1260

Note.—Stresses and pressures are in pounds. 1/40 should be used in all cases of straight incline planes. 1/32 should be used on haulage roads moderately curved. 1/25 should be used on haulage roads with sharp curves, and is a safe value to use in all cases of haulage roads likely to be met with up to 1¼ miles, on longer roads weight of rope should be added to load.

Example.—105 tons to be hauled up a road moderately curved, 30 per cent. slope stress in rope = 630 x 105 = 66,150 pounds.

Rule.—Multiply number opposite grade, and in column headed Friction, corresponding to kind of haulage road by tons to be hauled. Product equals pull in cable to haul load.

Colliery Notes, Observations and Comments

Practical Hints Gathered from Experience and from the Study of Problems Peculiar to Bituminous and Anthracite Coal Mining

DEVELOPMENT AND MANAGEMENT

The miners of the Pittsburg region object to the compulsory use of smokeless powder. The inspectors contend that it would diminish the danger of explosions while the miners claim they cannot earn as much when using it.

The coal operators in Wales not only sprinkle the floors and gangways of dusty mines, but also wet the cars and the coal as well as the roof and sides of gangways and shafts. They have also installed dust-proof doors at the mouth of intake shafts and slopes to prevent the dust from entering from outside.

Jerking is ruinous to ropes. The following experiments made with a dynamometer show the importance of careful hoisting:

	Tons.	Cwt.
Cage—4 cars weighed by machine	5	1
Cage—4 cars lifted gently.....	5	3
Cage—4 cars lifted with 3-in. slack rope.....	8	10
Cage—4 cars lifted with 6-in. slack rope.....	10	10
Cage—4 cars lifted with 9-in. slack rope.....	12	10

The longwall method of working may be applied to flat seams by having the working face in a straight line, and, provided the seam is not much broken by faults, by having the hoisting shaft as near the center of the available coal area as possible. Flat seams are much easier worked by coal-cutting machines than are highly inclined beds, also coal conveyers can be used economically in flat seams if the line of face is kept straight.

If in sinking a shaft it becomes necessary to use a part of the shaft for ventilating purposes, the compartment thus set aside must be separated from the remainder of the shaft by an air-tight partition. This is sometimes done by using pieces of heavy bunting laid in cement or tar and set close to each other. Another satisfactory method is to use 2-in. planks spiked firmly to each other; building paper should be placed between the planks and the joints should alternate.

Circular by-product coke ovens are considered by many coke experts as preferable to any other form of oven because of their cheapness of construction, greater stability, uniformity of heating, and large output. They can be bound on the outside with simple metallic bands and require only one-quarter of the expensive foundations called for by the horizontal ovens. The outside walls can be constructed of common brick, built independent of the fire-brick tiles which form the inside lining.

The influence of the size and design of pulleys and drums on the ropes which work upon them should be carefully noted. The main point in determining the size of pulleys for underground haulage is convenience of handling. A satisfactory workable minimum diameter of an underground pulley has been fixed at 60 times the diameter of the rope. Thus a ¾-in. diameter rope would require a pulley 3 ft. 9 in. in diameter. If the pulley is larger, so much the better, but if it is much smaller there is risk of injuring the rope.

Where the permanent lining of a shaft sunk by freezing is to be of timber, only perfectly dry wood shall be used, since the frost speedily shatters green or wet timber. In concrete or cement work, the frost also exercises a destructive action. To render this latter material frost-proof, a solution of soda or chloride of magnesium is sometimes used, but this has been found to reduce the strength and solidity of the concrete. A quick setting concrete impregnated with a 20 per cent. solution of a chemical preparation called "calcium" has been found to answer admirably.

Where a large amount of round coal is required, the longwall system of mining gives good results provided the coal is of a soft nature, or if the roof and floor are harder than the seam. Thick seams from 6 ft. and over, that are clean coal or that make but little refuse, are best worked by narrow work. If worked longwall, a bed of clean coal does not supply sufficient packing material to pack the places or sides of the gangway. The greatest disadvantage of working thick seams by the longwall method is that they cannot be packed tightly and consequently allow gases to accumulate in the gob.

Stop valves used for boilers should be so placed that water cannot rise above them. If the pipe rises above the boiler nozzle before turning horizontal, the stop valve should be in the horizontal run. If a long bend leads out of the boiler nozzle, the stop valve should be placed at the highest position of the bend. The valve should be provided with a drain pipe when placed in such a position as to accumulate water above it. The best results can be obtained by using two valves, one placed as near the boiler as possible, and the other at the junction of the boiler pipe and the main leader, with a drain pipe placed between the two valves to tap any water due to leakage through the leader valve. The feed valve should always be a globe, as the gate valve cannot be regulated closely, and often clatters owing to the pulsations of the feed-pump.

Many of the difficulties experienced with pumping apparatus in the anthracite field have been due to the corrosive action of the mine water. In some collieries the water is so highly saturated with acid, and will attack the iron so rapidly that in a few weeks a cast-iron pipe is completely out of service. In order to prevent the rapid destruction of the parts exposed to the action of the water such parts should be made very thick. Good results are often obtained by lining the parts with brass; also elbows and branches carefully lined with wooden staves give good results. Wooden column pipes are used in a number of collieries and experience shows them to have many advantages over the cast-iron pipe commonly employed; however, when a large column is required, a cast-iron pipe is generally preferred.

Some English mining companies require special training for all their hoisting engineers. A boy comes to them at about thirteen years of age, he is kept in the engine house cleaning and oiling engines until fifteen years old, when he is put into the fire hole and works with the stoker. In this position, he helps in cleaning the boiler fronts and in looking after the donkey engine to feed the boilers; he also assists in cleaning the inside of the boilers. At sixteen the boy is made assistant stoker with a little more responsibility put upon him but practically does the same work as before without quite the same supervision. At eighteen, if he has proved himself competent, he is given the position of boiler minder. Then if he is attentive and steady with good hearing, eyesight and physical strength, at from eighteen to twenty-one he is eligible to be put on hauling and pumping engines. At twenty-two if he still bears a good character and has been apt in the performance of his previous duties, he is taught to wind at a winding engine where water is hoisted. Here he becomes competent to take the place of a hoisting engineer when the opportunity presents. When such vacancy occurs an experienced man is placed with him for a time to accustom him to the peculiarities of the engine. Although by law eligible at the age of twenty-two for the position of hoisting engineer it rarely happens that a man under twenty-eight attains to this position. This system of apprenticeship has been found effective in lowering the death rate resulting from hoisting accidents.

Two Portable Assay Furnaces

By Evans W. Buskett*

The objections of a landlord to the installation of a heavy coal furnace in the second story of his building resulted in the design of the portable coal furnace constructed of brick and sheet iron, shown in an accompanying illustration.

The furnace rests on a wooden table 21 in. high. This table is covered with brick and may be extended to one side and used for pouring. The ash pit is made of red brick, while the upper part, or furnace proper, is made of fire-brick. The ash pit and table top will require about 100 red brick and the furnace 125 fire-brick. The mortar used should be made of fireclay and portland cement, about 90 per cent. fireclay and 10 per cent. cement. If fireclay cannot be obtained ground muffles will answer the purpose. They should be ground to pass a 20-mesh screen.

The furnace is designed to be portable, being held together by sheet-iron plates. It may, however, be held together by angle irons and eyebolts, which is cheaper in construction, but does not make a portable furnace.

The furnace takes a 9x15-in. muffle which is 45 in. from the floor. Furnaces of this design can readily be constructed to take larger or smaller muffles and can also be made two stories high if desired. The cost of this furnace should not exceed $20, provided that the assayer does his own brickwork.

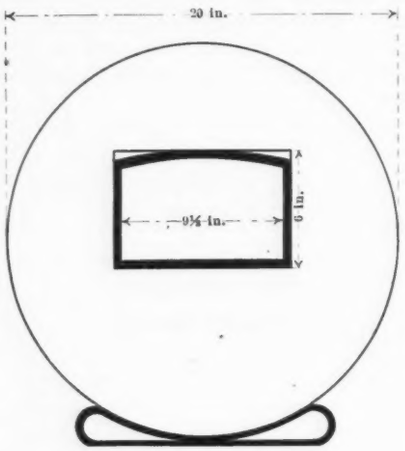
Concrete Gasolene Furnace

A portable gasolene furnace of my design is shown in two sketches. The furnace is molded in a sheet-iron cover 20 in. diameter and 21 in. long. This should be made by a cornice maker and the ends of the cylinder should be turned around a stiff wire. The core for the furnace chamber is made of wood in three pieces: A box made of ½-in. boards and tapering toward the front of the furnace for the main body; a plug for the furnace hole; and a small piece for the flue above the muffle. The core is assembled upon a board about 2 ft. square and the sheet-iron cover placed over it and centered by driving nails around the outside.

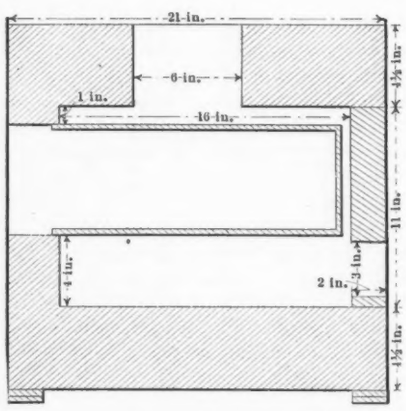
The mortar used should be made of 90 parts muffles or other burnt fireclay, ground to 20 mesh, and 10 parts portland cement. A little fireclay may be used, but it is not advisable, for it tends to crack on heating. The mortar should be thoroughly mixed before adding any water. Water is then added until a good stiff mud is worked up. It is then put in, a few pounds at a time, each portion being tamped down hard before the next is put in. After the mold is full the top is smoothed over and the furnace allowed to dry. This will take several days; the mass should be perfectly dry before attempting to take out the cores.

In taking out the cores the flue plug should be taken out first. Then the furnace should be reversed, setting it on its back end, and the board taken off the front, after which the door core is removed. The furnace is now set on its front end and the central core split with a chisel. If there is any difficulty in getting the box out it will be better to kindle a fire in the furnace and burn it out.

The back of the furnace is made in a separate mold, the core for the burner hole being made slightly tapering. The



CONCRETE ASSAY FURNACE



LONGITUDINAL SECTION CONCRETE ASSAY FURNACE

legs of the furnace are made of an old wagon tire bent into the shape shown.

In starting the furnace it should be heated very gradually to prevent cracking. The amount of cracking should be slight. If the furnace shrinks a thin grout of plaster of paris may be poured between the sheet-iron cover and the clay.

The cost of this furnace should not exceed $10 for materials.

*Metallurgical engineer, Peoria, Ill.

Consul Clarence A. Miller, of Matamoras, reports considerable activity in the exploitation of bat caves in that part of Mexico for utilizing the guano deposits.

Phosphate Rock in Tennessee

By H. D. Ruhm*

Shipments of phosphate rock from points in Tennessee on the Louisville & Nashville railroad, during 1905, 1906 and 1907, were as shown in table 1, the figures being given in tons of 2000 pounds.

TABLE I.

1905.	Domestic.	Export.	Total
January	34,168.45	3,652.25	37,820.70
February	17,714.80	11,474.35	29,189.15
March	26,148.35	1,017.60	27,165.95
April	23,145.95	11,662.20	34,808.15
May	22,927.35	13,814.10	36,741.45
June	22,860.15	14,378.20	37,238.35
July	21,802.15	10,505.70	32,307.85
August	24,070.75	9,404.40	33,475.15
September	21,805.15	5,641.30	27,446.45
October	19,849.20	7,512.95	27,362.15
November	23,631.20	7,933.35	31,564.55
December	27,187.60	13,411.35	40,608.95
Total	285,321.10	110,407.75	395,728.85
1906.			
January	56,402.70	1,182.75	57,585.45
February	23,602.11	4,055.20	27,657.31
March	38,296.86	15,913.65	54,210.51
April	35,851.70	10,688.40	46,540.10
May	18,494.50	3,705.30	22,199.80
June	27,598.55	19,564.25	47,162.80
July	24,856.45	11,668.95	36,525.40
August	29,453.22	16,161.65	45,514.87
September	31,600.36	8,392.95	39,993.31
October	25,822.57	10,377.55	36,200.12
November	35,235.40	841.95	36,077.35
December	32,780.10	7,961.15	40,241.25
Total	379,894.53	110,513.75	490,408.28
1907.			
January	36,130.96	11,659.60	47,790.56
February	31,209.85	.....	31,209.85
March	24,576.89	9,860.00	34,436.89
April	44,918.93	12,560.50	57,478.43
May	44,326.76	13,192.75	57,519.51
June	54,588.25	10,957.55	65,545.80
July	50,363.29	8,547.10	58,910.39
August	59,918.15	8,254.60	68,172.75
September	49,039.22	8,890.30	57,929.52
October	43,777.90	5,865.55	49,643.45
November	49,097.30	8,745.45	57,842.75
December	35,739.12	4,463.35	40,202.47
Total	523,686.64	102,996.25	626,682.89

A study of the statistics of shipments from the Tennessee phosphate field affords some exceedingly interesting comparisons, and throws some sidelights on the present situation which may be elucidative of some hitherto unexplained conditions. A comparison of the January shipments since 1905 is shown in table II.

TABLE II.

Year.	Domestic.	Export.	Total.
1905	34,168.45	3,652.25	37,820.70
1906	56,402.70	1,182.75	57,585.45
1907	36,130.96	11,659.60	47,790.56
1908	2,010.00	9,000.00	11,010.10

February shipments since 1905 compare as shown in table III.

TABLE III.

Year.	Domestic.	Export.	Total.
1905	17,714.80	11,474.35	29,189.15
1906	23,602.11	4,053.20	27,657.31
1907	31,209.85	.....	31,209.85
1908	8,070.00	6,570.00	14,640.00

The comparison shown in table IV is for January and February combined, which represent the usual heavy shipping months, just before the fertilizer shipping seasons.

*Mt. Pleasant, Tenn.

TABLE IV.

Year.	Domestic.	Export.	Total.
1905	51,883.25	15,126.60	67,009.85
1906	80,004.81	5,237.95	85,242.76
1907	67,340.81	11,659.60	79,000.41
1908	10,080.00	15,570.00	25,650.00

It thus appears that the winter season of 1907, when such a rush was supposed to be on for rock, was in reality very little above the mean for the years 1905, 1906 and 1907. However, the remaining portion of 1907 continued on such a rush, that shipments in that year exceeded 1906 by 144,000 tons of domestic, with a decrease of 8000 tons export. If we consider the increase from 1905 to 1906 as the normal increase of domestic shipments, we will find that the 1907 increase exceeded the normal by 50,000 tons, which, if taken as the amount purchased ahead of requirements by manufacturers during the summer and fall of 1907, would account for the deficiency of January and February shipments for 1908.

From this view of the case, it would appear that manufacturers generally have simply covered their requirements during last year, as far as possible, to prevent the annual squeeze that has hitherto taken place, from inability of miners to ship very largely during the winter months, except from storage. This view of the matter also explains to a great extent, the very small amount of rock in storage on Jan. 1, 1908. On the whole, it would seem that the phosphate business is so far really about normal, even with the generally unfavorable financial conditions, and it is quite probable that by preventing, as it did, the overdoing of the matter, this late panic will prove to have been a blessing in disguise, and will aid more than anything else in keeping prices up to a normal figure for the remainder of the year.

Judging by the way manufacturers are beginning to order shipments on their old contracts, and from the strenuous effort being made by them through brokers generally to secure low priced quotations, we are justified in predicting that their excess supply is about exhausted, and we may reasonably look forward to the activity shown during the corresponding period of 1907.

Most of the plants in the field have again started up and while few of them are running day and night, they are all expecting to do so in a short time, and are casting about for foremen and laborers, both skilled and unskilled, to be in a position to go into full operation on short notice.

It is interesting to notice that the export business for the last three years has been just about the same, and that all the increase has been in domestic consumption.

In the Kalgoorlie district, West Australia, 3⅝-in. piston drills are used for shaft sinking. In stoping, 3¼-in. and 2½-in. drills are used, and in case that the ground is favorable for drilling 2-in. machines are used. For cutting hitches for timbers, and for block-holing boulders, air-hammer drills are being rapidly introduced.

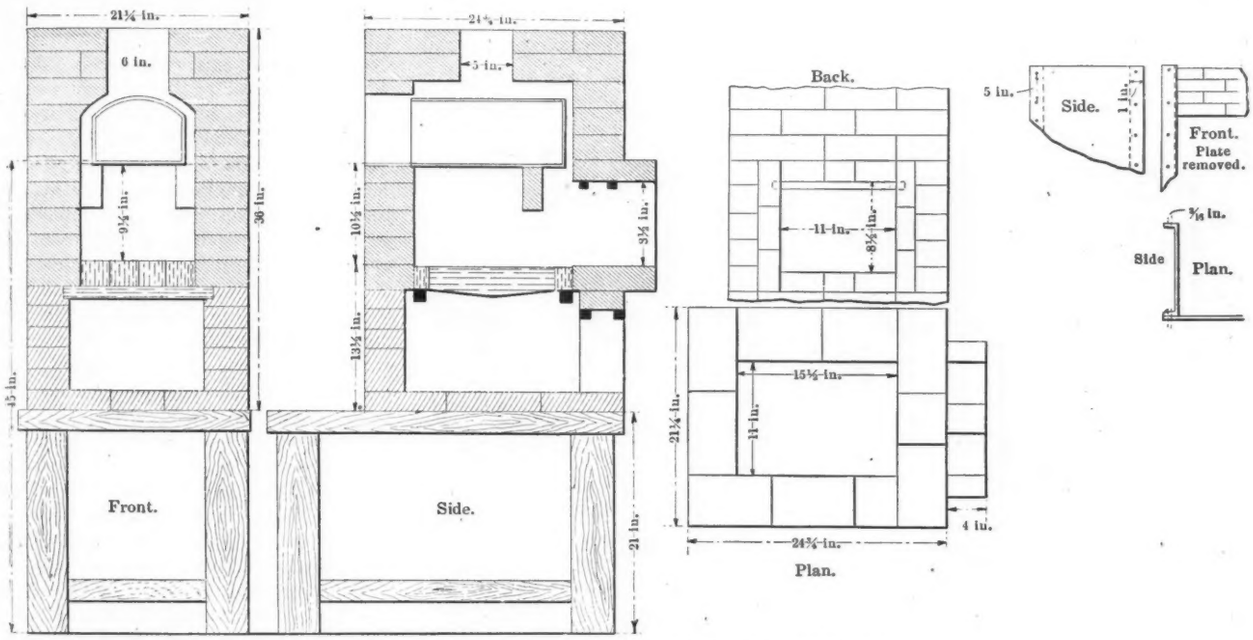
All important progress in milling silver ores except in the pan-amalgamation process has been accomplished in Mexico. The patio process was discovered and developed in that country; the hyposulphite process, although first used elsewhere, was developed there; finally by experimenting on Mexican ores the cyanide process has been adapted to the treatment of silver ores.

Method of Drying Oil Concentrates

By R. Storen*

Concentrates produced by the Elmore oil process are "oil wet" as well as "water wet." The standard temperature of 110 deg. C. used for drying wet samples does not have the desired result when employed for samples of this kind, for at this low heat the components of the oil can be only partially removed. The dry sample is the only possible basis for control assays and it is therefore necessary to choose a standard method of drying.

The following method, which is used at the Nautanen Kopparfälts laboratory has been proposed: About 500 gram wet concentrates are placed in a weighed aluminum dish. The dish is heated above a flame; it should be placed so high above the flame that no part of the dish is likely to become red hot. When all the water has been evaporated and the heat rises the oil is lighted and allowed to burn off, the mass being stirred constantly with an aluminum spatula. Concentrates dried in this way show lumps still containing some oil. The lumps must be broken up, passed through a 30-mesh sieve, weighed and again dried in the manner described.



SECTIONS AND DETAIL OF PORTABLE ASSAY FURNACE

At Wickes, Mont., galena ore, containing blende and pyrites, in a gangue of quartz, occurs in fissure veins (from 1 to 10 ft. wide) near the contact of granite and liparite, but cutting both rocks. The Helena Mining and Reduction Company (Alta Montana mine) and the Gregory mine were the chief producers.

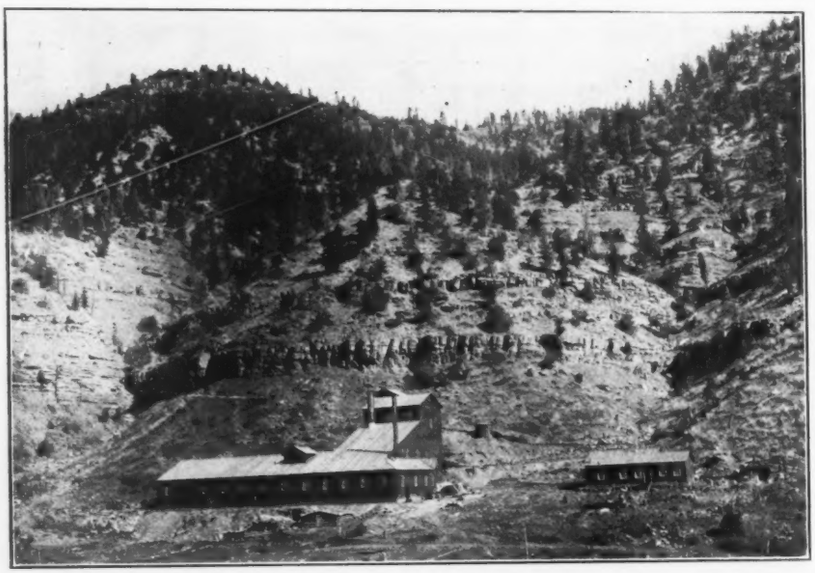
*Nautanen, Sweden.

Occurrence of Vanadium near Telluride, Colorado

By Edward R. Zalinski*

At the present time attention is being given to vanadium, tungsten, molybdenum, and titanium, on account of their properties in hardening steel. Tantalum and uranium have also been tried experimentally for this purpose, while manganese, nickel, and chromium have been used commercially for some years. Uranium and vanadium occur in small quantities in various parts of Utah and Colorado. It is the purpose of this article to give a few notes on the occurrence of vanadium on Big Bear creek, about 14 miles west of Telluride, Colorado, and about two miles south of Wilson station or Newmire, on the Rio Grande Southern narrow-gage railroad.

A plant for the reduction of vanadium ores is located at Newmire, and the mill supply is obtained from the deposits on Big Bear creek. Brief mention of the mill of the Vanadium Alloys Company has appeared at various times, but as far as the writer is aware nothing has been published regarding the ore occurrence, except that the vanadium-bearing rock was mined in the neighborhood, along the San Miguel river.



REDUCTION WORKS, VANADIUM ALLOYS COMPANY

Vanadium deposits at Placerville, six or eight miles to the northwest, are described by W. F. Hillebrand and F. L. Ransome, "On Carnotite and Associated Vanadiferous Minerals in Western Colorado."† The deposits on Big Bear creek occur at the same geological horizon and are of a similar nature to those at Placerville, though in the former locality little or no carnotite is present in the ore.

*Mining engineer, Salt Lake City, Utah.

†U. S. Geol. Survey, *Bulletin* No 262, pp. 9-31, 1905.

Geology

The deposits occur in sedimentary rocks. Vanadium is found in a bed of white sandstone lying beneath a bed of black limestone and above thick, red sandstone beds. Big Bear creek rises near Mt. Wilson and cuts through the sandstones, shales and grits, emptying into the San Miguel river at Newmire. The beds lie nearly horizontal and give rise to the characteristic mesa topography of the neighborhood. Both the cañons of the San Miguel river and Big Bear creek have steep walls and afford good exposures. On Bear creek the lowest rocks are a series of reddish sandstones and conglomerates of Triassic age. These are mapped by the United States Geological Survey‡ as the Dolores formation. Above this comes the La Plata sandstone (Jurassic), consisting of two white sandstone beds, separated by a thin black limestone; the vanadium deposits occur in the lower bed of white sandstone. On top of the La Plata sandstone and extending to the level of the mesa above, is the Mc Elmo formation of alternating sandstones and shales. The prevailing color of these formations is red and all belong to Juratriassic age.

The La Plata sandstone is exposed along Big Bear creek for two miles south of Newmire, where it is covered by the McElmo formation. It outcrops along the cañon of the San Miguel river, four and a half miles east of Newmire to where the Lake Fork of the San Miguel joins the main river; northwest of Newmire it is exposed along the cañon at least three miles to Sawpit, and beyond, in the direction of Placerville. The sandstone also outcrops again at the head of the valley surrounding Telluride and Pandora, and in the southeast and southwest parts of the Telluride quadrangle. As far as developed it is only workable for vanadium at certain points, though both vanadium and uranium minerals are found widely distributed in San Miguel and Montrose counties, and occurrence extending into southeastern Utah.

‡Telluride Folio, No. 57, Geologic Atlas of the United States.

Mineralogy of the Ores

The vanadium occurs as an impregnation of the sandstone and the supply for the Vanadium Alloys Company is at present being mined about one and one-half miles south of Newmire on Big Bear creek. Vanadium occurs at several other points. The sandstone is being worked on the east side of the cañon by open cuts and short tunnels. It is blasted down and loaded into cars which carry it to the ore bins situated on the creek. From here it is hauled by wagons to the mill at Newmire. The bed of sandstone mined here is up to 9 ft. thick. It is impregnated with an olive-green mineral which is probably the vanadium mica, roscoelite . The zone of vanadium impregnation is parallel to the bedding, and varies in thickness and intensity. The sandstone changes from light buff in color to dark olive green where richest in roscoelite. Occasional lighter streaks and irregular bands of sandstone are inclosed in the richest portions. The ore is said to average from 3 to 5 per cent. vanadium oxide, though portions of the bed run higher.

In the Placerville deposits some carnotite occurs in minute yellow specks in the sandstone near the bottom of the vanadiferous zone, but here as on Bear creek the chief vanadium mineral is roscoelite. On La Sal and Rock creeks, in the western portions of Montrose county, carnotite is the most abundant mineral.

Hand specimens of the rock from Bear creek show a medium fine-grained sandstone of dull olive-green color containing small silvery-white specks of mica and occasional spots and patches stained with limonite. Rock sections of the Placerville sandstone examined by Ransome showed the quartz grains often to be surrounded or cemented together by roscoelite. This is grass green in thin section and resembles chlorite; it sometimes shows an indistinct foliated or fibrous structure. No rock sections of the Bear creek occurrence were available, but in its physical properties it corresponds closely with that described by Hillebrand and Ransome. Both the Bear creek and Placerville occurrences are in the lower bed of the La Plata sandstone directly beneath the bed of limestone or dark calcareous shale.

Treatment of the Ore

The vanadiferous sandstone milled at the plant of the Vanadium Alloys Company at Newmire carries from 2 to 6 per cent. of vanadium oxides, mostly as V_2O_3, with a small percentage of V_2O_5. The treatment consists of crushing and

roasting the ore with salt, leaching with water and precipitating with ferrous sulphate, the final product being a ferric vanadate which contains from 40 to 70 per cent. V_2O_5. An outline of the process is as follows, the present capacity of the mill being 12 tons a day: Ore is brought down Bear creek to the mill by wagons, and is hauled up an incline to bins by a self-dumping car. From here it passes through a Blake crusher which reduces it to 1-in. size. Coarse rolls crush it to pass a four-mesh screen, after which it passes through a set of fine rolls which crush to 20-mesh. Circular, impact, revolving screens of about 4 ft. diameter are used. The screens are double, 4- and 20-mesh, the oversize going back to the rolls. Salt is fed in with the ore during the crushing process and this mixture passes in at the head of a reverberatory furnace and is rabbled and stirred down the hearth by hand. When roasted thoroughly it is dumped on the cooling floor.

Roasting with salt forms sodium vanadate and sets free chlorine which smells strongly in the upper part of the mill. Sodium vanadate is easily soluble in water; the roasted ore, after cooling, is put into tanks with water and agitated by blowing air through it. It is possible that some vanadium chlorides are formed during the roasting; there is little or no vanadium left in the roasted and leached residue, so that if vanadium chlorides or oxychlorides were formed, they are undoubtedly decomposed and leached out. The solution containing sodium vanadate, possibly also some vanadium chloride, is pumped into other tanks and the vanadium precipitated as ferric vanadate by the addition of ferrous sulphate. The precipitate is collected on press filters and taken to the drying room where it is dried slowly to a lumpy powder of dark olive-green color.

The mill has been in operation since 1906. A very small amount of uranium occurs with the ore; this is probably due to fine particles of admixed carnotite, which, however, are not separately visible. The accompanying illustration of the reduction works of the Vanadium Alloys Company at Newmire shows the outcrops of the Dolores, La Plata, and Mc Elmo formations, on the north side of the San Miguel cañon. The two prominent beds of the Le Plata sandstone outcrop behind the mill, though no vanadium is mined at this point.

From the year 1890 to the close of 1906, 22,840 men met death in the coal mines of the United States. Not since 1907 has the annual list numbered less than 1000 and each year the number has grown larger. In 1906 the fatalities were 2061 and the figures for 1907 will be still greater, notwithstanding the added precautions taken and the many safety devices installed.

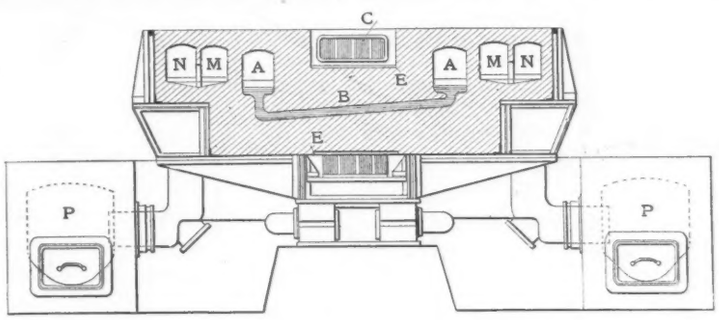
Storage Battery Locomotive

Glückauf, of March 28, describes a type of storage-battery locomotive that has recently been installed in a coal mine near Sölde, and gives some data as to its operation. It was built by the Lahmeyer firm in Frankfort. The batteries are contained in two movable wooden boxes; facilities are provided for lifting off a spent battery at a charging station and taking on a freshly charged battery, without undue loss of time.

With its batteries, a locomotive weighs about 5.5 tons, develops 19 h.p., and is built for a 23-in. gage. The battery itself weighs about 2.5 tons. It consists of 84 elements, and with one charging will yield 74 ampere-hours if charged slowly, or 60 ampere-hours if charged rapidly. It will haul 25 or 30 loaded cars holding one ton of coal each up a 0.4-per cent. grade at a speed of about seven miles per hour. With one charging it can make three trips with loaded cars, returning with the empties, for a distance of one kilometer.

The Gin Electric Furnace for Zinc Smelting

As described by G. Gin in French patent, No. 382,872, of Oct. 17, 1907, the furnace is an electrical induction furnace, the primary circuit consisting of windings of copper wire *C*, and the secondary circuit of a bath of molten iron contained in the two distillation chambers *A*, which communicate by the channel *B*, also filled with molten iron. The insulated copper wire is protected from radiated heat by water-cooled plates *E*, between which and the windings are channels through which cold air is passed. The mixture of zinc ore and carbon is charged mechanically into the distillation chambers *A*. Molten zinc condenses in the first condensation chambers *M*, which are at a temperature of 500—700 deg. C. Further condensation is effected in the second condensation chambers *N*, and the vapors then deposit zinc dust in further chambers *P*, before they pass into the chimney (not shown). At the end of the distillation, the zinc is run out of the condensation chambers by tilting the furnace, and the residues in the distillation chambers are rabbled off, without interrupting the heating. The lining of the furnace consists of bricks of dolomite and magnesia.



SECTIONAL ELEVATION, GIN ELECTRIC FURNACE

The Rumanian Petroleum Fields

According to *Le Journal du Petrole*, the oilfields of Rumania extend along the foot of the Carpathians for a distance of 550 km. with an average width of 20 km. According to the methods of exploitation hitherto practised, it is estimated that an acre of land produces an average of 10,000 tons of oil (one ton contains about 7 bbl.). The productive area of the belt is conservatively estimated at 600,000 acres, and assuming an output of only 6500 tons per acre, the petroleum resources of Rumania can be figured at about 4,000,000,000 tons. During the last 40 years the total production has scarcely reached 10,000,000 tons, the largest annual output having been made in 1907, when 1,129,097 tons were produced. The methods and equipment of the Rumanian oilfields are said to be as modern and improved as anywhere else in the world.

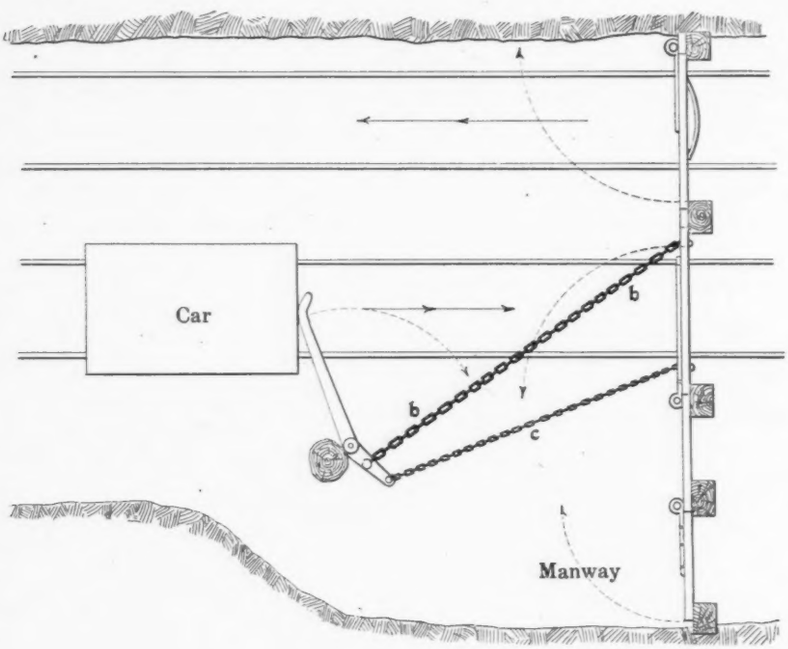
M. Simonis reports (*Stahl und Eisen*, 1908, XXVIII, 334-335) the determination of the melting points of mixtures of chromite (Cr_2O_3 52.9, FeO 22.6, Al_2O_3 4.8 MgO 10.1, SiO_2 9.6) and Zettlitz kaolin. As the percentage of chromite increased from 0 to 30, the melting point fell rapidly from Seger cone 35 to 17, then less rapidly to cone 15 at 65 per cent. (the eutectic point). It then rose rapidly, reaching cone 35 again at 80 per cent., cone 41 at 90 per cent., and higher undetermined temperatures with higher percentages of chromite. Chromite can therefore be mixed with as much as 10 to 15 per cent. of kaolin for plasticity, and still yield a highly refractory mass.

Greater rigidity of drill steel increases the rapidity of drilling with ordinary piston air drills. Several engineers in South Africa have recently stated that the increase in the speed of cutting is very noticeable as the diameter of the shank steel is increased.

Self-operated Mine Door

Der Bergbau, Mar. 26, 1908, describes an automatically operated door for use in coal-mine airways. The door is opened by the motion of the approaching car, and closes itself by gravity, assisted by the pressure of the air current. It has been in successful use in a number of German mines.

A lever is attached to a timber prop at the side of the haulage way in such a manner that the longer arm projects out over the track so as to be engaged by the front end of an approaching car. To the shorter, inner end of the lever are attached two chains, *b* and *c*, the other ends of which are made fast to the door. The lengths of the chains are so adjusted that when the door is shut, the chain *b*, which is the nearer to the fulcrum



SELF-OPERATED DOOR

of the lever, but the farther from the hinge of the door, shall be taut, while the chain *c* hangs somewhat loosely. In this way the maximum force can be applied to the door at the start, when it is most difficult to move; when the door has been partly opened by chain *b*, and the air pressures on the opposite sides have been partially equalized, the chain *c*, with the smaller force comes into action, and is able to draw the door wide open, while the chain *b* falls loosely. The hinges are set in a line inclined from the vertical, so that when the restraint is removed, the door tends to fall shut.

The little door at the side for men to pass through, shown in the illustration, is a feature that might be copied to advantage by many American coal mines.

Contact with water lowers the efficiency of dynamite.

Norwegian Copper Mining in 1907

The high prices for copper prevailing through most of 1907 stimulated active operations at the many different localities at which cupriferous pyrites is mined in Norway. The two leading mines produced in 1907 a little over 1300 tons of copper metal, and the total Norwegian output of pyrites, most of it cupriferous, in the same year, was about 225,000 tons, to which should be added a little chalcopyrite. Up to the end of November, Norway had exported 179,000 tons by sea and 2000 tons by rail, and had consumed 30,000 tons at home. The number of workmen at producing mines was 4000, while 1000 more were employed at mines undergoing development.

The Sulitjelma mine employed 1700 workmen and produced 115,600 tons of ore; 11,873 tons of it, averaging 6.2 per cent. of copper, was smelted at the plant, yielding 701 tons of copper. The smelting is done by the Knudsen process, the advantage of which is the reduced amount of fuel needed. Improvements during the year resulted in lowering the loss of copper from 15 per cent., by former methods, to 10.4 per cent. The Elmore process is being installed at the dressing works, to reduce the loss of mineral during concentration.

The Alten mines, in Finmark, employed 247 workers, and produced 4150 tons of ore, of which 3646 tons were put through a preliminary fusion, yielding 1048 tons of 18-per cent. matte which was then shipped to the Sulitjelma plant.

The Roeraas mine, with 700 workmen, produced 321 tons of refined copper and 12,700 tons of ore, most of which was concentrated. The Rosmo mine yielded 23,000 tons of concentrated ore, which has been about its average output for some years. The Foldalen mine, after completing a large installation, produced 40,000 tons of ore in spite of a strike during the last three months.

At a number of other mines, not hitherto producers, extensive developments were carried on during 1907. The Meraker mine installed a hydroelectric station, aërial trams and washeries, all of which are expected to be in operation this year. A matting furnace was built at the Moskodalen mine. The Storoold mines erected equipment for a large output; the ore carries 3 per cent. copper and 40 per cent. sulphur. The Meldalen mines built a railroad to their shipping port, and have a washery under construction.

The production of copper-bearing pyrites in recent years has shown notable growth, and an annual output of 350,000 tons is expected in the near future. The domestic consumption has likewise increased, the paper-fiber industries being large users.

Norwegian Lead-Zinc Mines

In southeastern Norway during 1907 considerable energy was spent in the development of lead-zinc deposits.

At the Fraag mines a washery using the Elmore process was built, capable of treating 75 tons of ore per day. The process seems well adapted to this ore, 90 per cent. of the contained metals being recovered. An assay of 200 tons of finished blende concentrate showed 53 per cent. zinc, a little silver and only 2 per cent. lead. Similarly, 30 tons of galena concentrate showed 70 per cent. lead, a little silver and only 1.05 per cent. of zinc.

From the Hadeland mines several thousand tons of washery ore were taken, but most of the work was directed to the erection of plant. A washery, also using the Elmore process, is almost finished, and an aërial tram connecting the mine with its mill. The Hakedalen mines underwent active development resulting in the discovery of important bodies of milling ore.

Development in the lower levels of the Konnerud mines showed the orebodies to be continuous to that depth. Considerable quantities of crude ore were sent to the mill, which also uses the Elmore system. The products are blende containing 43 per cent. zinc, and galena carrying 70 per cent. lead and 1.5 kg. of silver per ton.

A simple method of collecting mercury which has been spilled on the floor or table is to make a wet ring around it and scoop up the mercury on a piece of stiff paper. The mercury cannot readily pass the wet ring.

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The Amalgamated and Anaconda Reports

The reports of the Amalgamated and Anaconda companies for their last fiscal years, which have just appeared, require no extended comment. That they would disclose unsatisfactory results, owing to the fall in the copper market, was well known. About the only interest in the reports is the disclosure of the policy of the management with respect to the labor situation, the shut-down of the mines, and the general scheme of operation. In general, the reports are of the usual unsatisfactory character because of the absence of details, financial and technical, which the stockholders have the right to expect. We have criticized these companies on this ground so often in the past that it seems scarcely worth while to revert to the subject.

However, it is fitting once more to call attention to this lamentable feature and remark upon certain phases of the Amalgamated company which are not commonly understood. The popular opinion, to a large extent, is unfortunately that the Amalgamated is managed by a great stock-jobbing syndicate. As a matter of fact, the company is one of the greatest industrial concerns of the United States, and physically is managed upon the soundest principles. It possesses wonderfully extensive copper mines at Butte, immense coal mines elsewhere in Montana, timber properties and sawmills, and indeed all of the principal accessories that are required in the operation of copper mines which in 1907 furnished upward of 20 per cent. of the domestic production of copper. At Anaconda and Great Falls are two of the largest smelting works of the world. The Washoe works at Anaconda support that fine city of large population. As an illustration of the scope of the industrial interests of the Amalgamated company, it may be mentioned that at Anaconda it operates an immense, magnificently equipped machine shop, at which nearly all of the machinery required by its mines and smelteries are manufactured. There are few, if any, machine shops in the West, especially conducted for the manufacture and general sale of mining and smelting machinery, which are equal to those at Anaconda, either in size or perfection of equipment. Also, at Anaconda the company operates a great brick-making establishment, in which common and refractory brick of all kinds are produced. The silica brick made at this plant has a very high reputation for furnace construction, and for that purpose is shipped to many parts of the United States.

In the conduction of these great enterprises by John D. Ryan, Benjamin B. Thayer, John Gillie, E. P. Mathewson and Charles W. Goodale, with their able corps of assistants, the company has the advantage of the highest order of engineering and managerial skill that the United States is able to furnish. No one can study the superb management at Butte, Anaconda and Great Falls with anything but a feeling of admiration for the high degree of excellence that has been attained, and the appreciation that there indeed is something worthy of emulation. The Amalgamated Copper Company has become industrially an enterprise in which the United States ought to feel pride. This makes it all the more reason to regret that in turning its face eastward toward its stockholders the company does not pursue the same policy of frankness that has won such high esteem for the United States Steel Corporation.

United States Steel Production

The total production of steel in the United States in 1907 was practically the same as in 1906, notwithstanding the break in demand in the closing months of the year. The decrease from 1906 was only 38,499 tons, or only 0.16 per cent. The total for 1907 was 23,359,637 tons, of which 11,667,549 tons were bessemer steel, 1,269,773 acid open-hearth, 10,279,315 basic open-hearth, and approximately 143,000 tons crucible and special steels. The year once more showed a great growth in the importance of open-hearth, and especially of basic open-hearth steel.

The production of steel for 10 years past has been as follows, in long tons:

	Bessemer.		Acid-Open-hearth.		Basic-Open-hearth.	
	Tons.	Per Ct.	Tons.	Per Ct.	Tons.	Per Ct.
1898.	6,609,017	74.8	660,880	7.5	1,569,412	17.7
1899.	7,586,354	72.0	866,890	8.2	2,080,426	19.8
1900.	6,684,770	66.3	853,044	8.5	2,545,091	25.2
1901.	8,713,302	65.2	1,037,316	7.8	3,618,993	27.0
1902.	9,138,363	61.6	1,191,196	8.0	4,496,533	30.4
1903.	8,592,829	59.6	1,094,998	7.6	4,734,913	32.8
1904.	7,859,140	57.1	801,799	5.8	5,106,937	37.1
1905.	10,941,375	55.0	1,155,648	5.8	7,815,728	39.2
1906.	12,275,830	52.8	1,321,653	5.7	9,658,760	41.5
1907.	11,667,549	50.2	1,269,773	5.5	10,279,315	44.3

Basic bessemer steel was never made in this country on a large scale, and has not been made at all since 1897. All the bessemer metal in the years given above was

acid steel. In this table the small quantity of crucible and special steels, which has never reached 1 per cent. of the total, is disregarded.

The conclusions from this table are obvious. The total make of open-hearth steel has increased in proportion from 25.2 to 49.8 per cent., while that of bessemer has fallen from 74.8 to 50.2 per cent. In quantities, the make of bessemer increased in 1907, as compared with 1898, by 76.5 per cent.; that of acid open-hearth 90.6, and that of basic open-hearth 555.0 per cent. The growth in basic open-hearth steel output has been continuous; it has shown an increase each year, even in the lean years when there were considerable decreases in other steels. The proportion of acid open-hearth steel to the total showed some decrease in the 10 years.

Had production continued at the same level as in 1907, there is no doubt that the open-hearth steel make for 1908 would exceed that of bessemer metal. Under present conditions, which are likely to prevail for a large part of the year, there is room for doubt. The open-hearth steel is largely used for sheets, plates and structural shapes, in which the decrease in demand will undoubtedly be greater than in the simpler forms of rails, bars, etc., for which bessemer metal is generally used. There is, however, a growing demand for open-hearth rails, which may help to equalize the difference. Even if it should not do so, the position of the open-hearth furnace ahead of the bessemer converter will only be delayed for a year.

Dr. Robert Bell

The retirement of Dr. Robert Bell on June 1 removes from active connection with the Geological Survey of Canada its senior member, and recalls the long and distinguished service he has rendered to the Dominion. He was one of the active staff which extended exploration into the wide expanse of territory which was practically unknown when the Survey was first constituted. His field-work extended through every part of Canada, and he was the first to undertake the geological examination of the Hudson Bay country, of British Columbia and the Yukon when they passed under control of the Dominion. He took an active part in the organization of the Survey, and in all the subsequent changes, and much of the work it has done was started on his initiative, especially in British Columbia and the Northwest territories.

Dr. Bell was acting head of the Survey from the death of Dr. George M. Dawson in 1901 until the appointment of Dr. A. P. Low in 1906, a period of five years. Since 1906 he has been chief geologist. His contributions to the papers and reports of the Survey have been numerous, and he has been the recipient of many honors, including the gold medals of the Royal Geographical and American Geographical societies. To him was largely due the constitution of the International Committee of the Canadian and United States surveys, which has done much in harmonizing and correlating geological work on the North American continent.

Steel Production in Great Britain

The production of steel in Great Britain, as reported by the British Iron Trade Association, was nearly stationary last year. The total make was as follows, in long tons:

	1906.		1907.	
	Tons.	Per Ct.	Tons.	Per Ct.
Open-hearth	4,554,936	70.5	4,663,489	71.5
Bessemer	1,907,338	29.5	1,859,259	28.5
Total	6,462,274	100.0	6,522,748	100.0

The gain of 108,553 tons in open-hearth metal was partly offset by a loss of 48,079 tons in converter steel; the total gain last year being 60,474 tons, or 0.9 per cent. The year slightly increased the lead of open-hearth over bessemer steel.

The division of the steel made in 1907 according to the process used was as follows:

	Acid		Basic	
	Tons.	Per Ct.	Tons.	Per Ct.
Open-hearth	3,384,780	51.9	1,278,709	19.6
Converter	1,280,315	19.6	578,944	8.9
Total	4,665,095	71.5	1,857,653	28.5

Thus last year 71.5 per cent. of all the steel made was by the acid process. The British preference for that process is well established, and the proportion will doubtless hold as long as supplies of low phosphorus ores are available. The proportion of the total steel to pig iron production was 63.7 in 1906, and 65.7 last year. This proportion is much lower than in the United States or in Germany. The puddling furnace is still more in use in Great Britain than in the other great iron-making countries, though it shows now some decrease. The output of wrought iron for the year was 1,010,346 tons in 1906, and 975,083 tons in 1907; a decrease of 35,263 tons.

Partial reports of the output of finished steel show that bessemer was preferred for rails, bars and similar forms.

A Copper-selling Combination?

The reports that conferences have been held in New York during the last few weeks among the leading metal-selling interests with a view of securing greater stability for the copper market, and for that purpose the formation of an association among the selling agencies not to "attempt to create artificial prices," but simply to "insure some kind of harmony" in the sale of the output of copper, are entirely without foundation. There is no basis for these reports beyond the wish that may exist in certain quarters to consummate such an arrangement. However, there is no good probability that such a project could be carried through. It would be of doubtful legality, and moreover would be contrary to the exercise of the natural laws of trade, which are not likely to be trifled with, as recent experience has shown once more. The inspiration of the recent reports appears to come from a surprising quarter, and the reports are evidently cast out as straws to see if the wind be favorable. Such being not the case, they will naturally be deprecated as journalistic vagaries.

Steel Prices

The reduction of $4 per ton on steel bars, made this week by one branch of the United States Steel Corporation, is the immediate result of the irregular market for iron bars which has prevailed for some weeks, resulting in low prices.

This cut is of importance, as being the first indication that the leading interest has recognized the demands of the situation, and is preparing to make concessions. Though the steelmakers were reported at the recent conference to be unanimous in the belief that prices should be maintained, it has been more and more difficult to hold the independent companies, who saw business going to small competitors not bound by any agreement. It is altogether probable that the bar reduction is only the forerunner of others, and that the end will be generally lower prices and consequent increases in business. The old law of supply and demand is at last forcing a recognition—as it was bound to do in time.

Views, Suggestions and Experiences of Readers

Comments on Questions Arising in Technical Practice or Suggested by Articles in the Journal, and Inquiries for Information

CORRESPONDENCE AND DISCUSSION

Leakage in Compressed-air Pipes

In the United Kingdom we have for some time been accustomed to reckon efficiency of compressed-air transmission, with the compressor on the surface, at only 25 to 30 per cent., and in some cases at even less than that, and the difference between the efficiency as it should be and this, is due to leakage. Mining engineers with whom I have discussed the matter, have explained to me that they are obliged to use cast-iron pipes, because of the greatly increased cost of wrought-iron pipes, and that with the working of the mines with which every mining engineer is only too familiar, it is almost an impossibility to keep the joints good.

I have suggested that the flexible metallic tube that is now largely employed for a number of purposes, and that I believe is made to stand pressures up to 300 lb. per sq.in., should be employed in special cases where the working of the mine is very awkward; or, failing the ability to do this on account of cost, that it should be employed for the joints beween lengths of pipe. The flexible metallic tube is unfortunately expensive, but I venture to think that a certain use of it, for joints, etc., would be beneficial, and would pay for the expense in decreased leakage.

In the United Kingdom, and on the Continent power distribution in mines is resolving itself very largely into the well known combination of electric current and compressed air, in which electric currents are employed to transmit the power to the neighborhood of the coal face, while compressed air is used for the actual working, the air compressor being driven by electric motors.

The low figures given for the efficiency of compressed air are confirmed very strikingly from the practice with drilling machines on the Rand. I understand that for every drill taking about 3 h.p., something like 12 h.p. is required in the air-compressing engine on the surface. Some years ago, when electric drills were put into one of the Cleveland iron mines, it was stated that something like 6 h.p. was able to do the work by electric current, where 100 h.p. had been previously required with compressed air. Matters have improved, of course, since then.

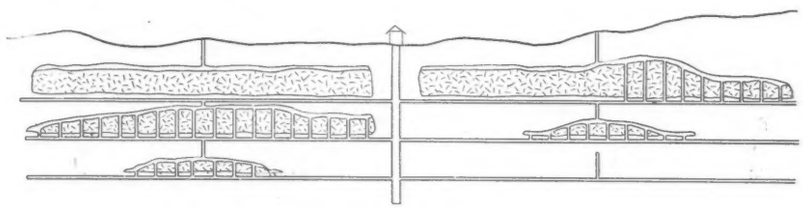
The great waste of power in compressed air, for drilling in particular, has encouraged electrical engineers to try and work out an electric drill. Rotary drills there are in plenty, and apparently doing well, requiring only about 2 h.p. each. There are also a number of electric percussion drills on the market, tests of which show that they require only about the same power as the rotary drill; but one hears very little of their use in actual work, under such conditions as those at the Rand mines.

SYDNEY F. WALKER.

Bath, England, May 13, 1908.

How Should This Mine Be Operated?

Since the copper vein of the mine mentioned by R. E. in the JOURNAL of March 21, is only 12 to 20 in. wide, considerable waste rock must necessarily be broken in stoping. Assuming that the separation can be made underground, as is probably the case, I suggest that the best way to mine the vein is by overhand stoping, using the waste as filling to support the walls and keep the work up to the back. If possible, resuing should be resorted to, the necessary waste first being broken; then planking or canvas should be laid, and the vein blasted. When blasting the latter, low-power explosives should preferably be used, so as to make as few fines as possible. If the vein is frozen to the walls resuing may not be possible.



PROJECTION ON THE PLANE OF THE VEIN

The accompanying illustration, giving a projection on the plane of the vein, shows the scheme of operation. The raises afford sufficient natural ventilation, and are useful for lowering timber. They may possibly be omitted if air-drills are used. After driving the main drifts, or simultaneously, a sub-drift is driven above, leaving a 10-ft. back over the main drift. This back is holed through at convenient intervals, say, 50 ft., and chutes are placed in the main drift; cribbing is also started upward at each opening. The back of the sub-drift is then attacked and the stope carried upward to within 10 ft. of the level above, milling the ore down to the level below, and leaving the waste in the stope. At intervals of several hundred feet, manways are cribbed up, and if the drifts are very long, more raises may be driven.

If more waste is broken than will fill the stope, alternate mills may be used for waste and ore, or the mills may be made with two compartments. If the waste is not sufficient, stulls and lagging may be placed at intervals in the stope to help keep the work up to the back. Whether or not the method of resuing, or stripping, is used, the ore should be broken upon a flooring of some kind to retain the fines, and assure the thorough sorting of all the ground broken. The ore is drawn from the chutes into cars, trammed to the shaft, and dumped into the skip, or into a pocket, if the production is near the hoisting capacity. Pillars 50 ft. wide should be left on each side of the shaft. Either hand or air drills may be used, but one-man air-hammer drills are probably best for such work, especially in the stope.

The chief advantages of this method are as follows: First, very little waste is hoisted, keeping down the hoisting cost per pound of copper. Second, the ore is won by overhand stoping, which means economical breaking. Third, the ore may be attacked on each level simultaneously, and at several points on each level if desirable, thus yielding a "maximum amount of ore in a given time." Fourth, the stopes are supported permanently by waste filling. Fifth, the levels may be maintained permanently, and no more ore is left than is necessary to protect the levels and the shaft. When the ore tributary to a level is exhausted the floor pillar may be taken, and possibly half of the back pillar. Sixth, natural ventilation should suffice to keep the air in the stopes fresh, with the aid of a little bratticing. Seventh, little ore is tied up in the stopes. Eighth, there is no timbering to keep in repair permanently except shaft timbering and lagging over the chutes in old stopes. Ninth, portions of the vein too thin or poor to pay may easily be left as pillars.

E. E. WHITE.

Calumet, Mich., April 3, 1908.

The Divining Rod—A Scientific Test

Several letters which have appeared in the JOURNAL during the past year seem to indicate that there are persons who still believe in the divining rod. In view of this fact an account of a trial of the instrument conducted at a recent meeting of the Philadelphia Mineralogical Club may be worth bringing to the attention of your readers.

It is comparatively rare for a man of scientific attainments to be permitted to witness the process of "divining;" and for an exhibition to be made before a scientific society is quite exceptional. We were so fortunate, however, as to learn of a man who was willing to exhibit his powers in this line at one of our meetings, and we gladly gave him every opportunity to do so. His claim was that he could detect and distinguish any of the commoner metals no matter whether they existed at the surface of the ground, or hundreds of feet below; and offered to tell the constituents of any mineral specimen we would submit.

A series of ores of the commoner metals was obtained and numbered to correspond with the names on a list, which was locked up in a safe. These were wrapped in paper and placed separately in small pasteboard boxes, all exactly alike, by a person who was not to be present at the meeting. Every possible source of unfairness was thus provided against.

MODUS OPERANDI

The "rod" used consisted of flexible material, in the shape of a "V" having a block of wood, with grooves and pins, to which small objects could be attached, at the apex. The operator explained that this rod was a mere mechanical device, and that the real power of "divining" lay in himself; every desired substance present would so affect him that the rod would dip downward, as if attracted, and this dipping would occur repeatedly until the attraction was neutralized by attaching an approximate object or "test" to the tip.

The rod was held horizontally, with the palms of the hands upward, and the tip bent rapidly toward the floor. The operator then inquired whether there was any water, or any iron object, in the building beneath the room in which the meeting was taking place, and on being informed of the presence of an iron boiler full of water, he hung on one of the pins a small vial of water, and inserted in one of the grooves an iron disk. On being held in position the rod now refused to dip down, and he said that the attraction was neutralized. (Upon trying it afterward, I was unable to prevent the rod from dipping even when thus "protected," but this may have been due to copper nails in my shoes!)

One of the boxes containing the specimens was then placed on the floor, and the rod held over it. Small disks of iron, with letters and figures upon them, each corresponding to some metal or valuable material, were successively inserted into the tip until the rod no longer dipped, and the composition of the mineral was then read off from the disks attached.

RESULTS OF THE TEST

Three specimens prepared in the manner described were tested in this way, as were also two samples submitted by members of the society. The results were as follows:

SPECIMEN.	REPORTED.
(1) Native silver in calcite	Gold, silver and lime.
(2) Pyrargyrite in calcite (silver sulphantimonite)	Copper and sulphur.
(3) Nickeliferous pyrrhotite	Bismuth.
(4) Trap rock with specks of chalcopyrite	Gold, silver, copper, lead, zinc and sulphur.
(5) Bog-iron ore	About the same as 4, with the addition of platinum.

It should be noted that the last two specimens were supposed by their owners to contain valuable metals; so there is a possibility that mind or muscle reading may have influenced the operators' conclusions. Then too, when questioned concerning the discrepancies in the other cases, that gentleman replied that he was able to detect traces of metals too minute to be recognized by "ordinary chemical processes."

The whole performance would have been ludicrous but for the complete sincerity and earnestness of the operator. It was, however, successful in that it served to convince every person present at the meeting of the utter worthlessness of the divining rod.

EDGAR T. WHERRY.
Recording Secretary of the
Philadelphia Mineralogical Club.
Philadelphia, Penn., May 27, 1908.

Mine Fires

The communication of H. N. Dodge in the JOURNAL of May 23, in reference to mine explosions and mine fires, has interested me. I am not familiar with the Cardiff, Ill., mine, or the Monongah mine, W. Va.; but it occurs to me that the presence of gas in old workings may have had something to do with the fire. However, I have never been in either mine, hence my opinion is of little value.

I have seen mine fires successfully handled in Illinois, Ohio and in Iowa, and in nearly every case it was necessary to wall them up tightly, after they had obtained such headway that it was impossible to turn them over by shovel. Conditions vary; hence different mine fires should be variously fought. For example, I have seen old workings in central Illinois mines kept open with a strong current of air passing through, and such fires as manifested themselves I have seen attacked at the beginning, the slacks when heated being turned over by shovel and scattered, or when very hot loaded and sent to the surface. In an old mine south of Springfield, Ill., fire in an area of 40 acres was successfully shut off by masonry stoppings.

In the Cardiff case I believe it would have been better to place a valve in the stoppings to allow the gases to escape into the workings when the pressure became too great for the walls to retain. About 15 or 20 years ago the panel system was employed at Pana, Ill., the first time, I think, in Illinois, and perhaps in the middle West. About 16 rooms were turned from each stub entry and, when the rooms were driven to their distance, the mouth of each stub entry was closed by a tight masonry stopping. The wall was well plastered and had an inch pipe with a valve on the outer end set in the wall about 2 ft. above the floor. The mine contained considerable gas, and the fire boss was accustomed to open these valves and allow the gas to escape at times when all the men had left the mine. The plan should work equally well in the case of fire; the valve would, on being opened, provide means of escape for the gases generated by the fire, and thus prevent bursting of the walls.

I saw a Vajen-Bader fire helmet in use at one of the Pana mines several years ago. I was told that it was successfully employed in fighting mine fires. I am not sure, but I think fire helmets were also used at Ziegler, Ill. In view of recent criticisms of American mine managers by the authorities and reference to the use of these helmets abroad, I am of the opinion that it is only fair that these facts should be placed on record.

"COAL."

Consul B. S. Rairden, of Batavia, quotes the prices and sales of Billiton tin in that Javan market for the first three months of 1908 as follows: January, 5500 slabs, each weighing 74.8 lb., sold at $0.2537 per lb.; February, 5500 slabs, each weighing 74.8 lb., sold at $0.2668 per lb.; March, 5500 slabs, each weighing 74.8 lb.; sold at $0.2625 per pound.

Consul George H. Scidmore reports that during the year 1907 a briquet company at Nagasaki manufactured over 35,000 tons of briquets, nearly all of which were delivered to the Japanese navy. The company's output during the current year is expected to reach 50,000 tons. This fuel is now sold at the factory at 17 to 18 yen ($8.47 to $8.96) per ton of 2240 pounds.

Amalgamated Copper Company

The report of this company, covering the year ended April 30, 1908, states that in the calendar year 1907 the companies owned wholly or in part produced from their ores mined and from custom ores a total of 212,000,000 lb. of refined copper; the Amalgamated company receiving the benefit of about 178,000,000 lb. of this total. The income account compares with the previous year as follows:

	1906-7.	1907-8.	Changes.
Net income....	$14,154,400	$ 6,680,557	D. $7,473,843
Dividends paid	11,926,312	6,155,516	D. 5,770,796
Surplus.....	$ 2,228,088	$ 525,041	D. $1,703,047
Balance from previous yr..	9,255,694	11,483,782	I. 2,228,088
Total surpl's	$11,483,782	$12,008,823	I. $ 525,041

The net earnings for the past year were equal to 4.3 per cent. on the stock. Dividends paid were 4 per cent. The balance sheet as of April 30, 1908, is as follows:

Investment in securities, etc., of all kinds	$156,480,647
Loan to Washoe Co. for smelter construction	7,200,000
Cash and cash assets	3,007,831
Total assets	$166,688,478
Capital stock; authorized $155,000,000 outstanding	$153,887,900
Accounts payable	22,315
Dividend No. 35, May 2, 1908	769,440
Surplus and reserve	12,008,823
Total liabilities	$166,688,478

The directors' statement says: "During the fiscal year of the company, which ended April 30, 1908, the fluctuation in the selling price of the copper metal was greater than at any other period in the history of the copper trade. At the time of the last annual statement, in May, 1907, there was an unlimited demand for the metal, the selling price at that time being in the neighborhood of 25c. per lb. This demand was afterward seriously affected by the severe financial depression throughout the country, and in the early summer of 1907 it suddenly slackened, and afterward almost altogether ceased. The price of copper meantime gradually declined; and during the last two months of the fiscal year, the metal has sold at from 12 to 13c. The business paralysis in the United States was, however, not fully reflected abroad, and most of the copper metal that was sold in the market (and this was a large quantity), was bought for European account, the purchasers taking advantage of the low price of the metal to replenish holdings, which had been allowed to become depleted during the former period of high prices. Immediately after the first falling off in the demand, there was a natural tendency on the part of the producers of copper to await better business conditions; and, during this period, as but little copper was sold, a large amount was naturally accumulated.

"After the price of copper had fallen considerably in the market, the officials of the various producing companies adopted the policy of curtailing the output from their respective mines at Butte. But, after operating for a period of several months under curtailed conditions, during which time the producing cost was far in excess of the normal (owing to the fact that each company was producing only a small part of its normal output), it was deemed advisable to confine all operations to one unit. The mines and smelter of the Boston & Montana Company at Great Falls were put in operation to their fullest extent and with satisfactory results. In February, 1908, the surplus stock of copper had practically disappeared; and, on March 1, 1908, the mines of the different companies and the Washoe smelter were again put into commission and are now being operated to their full capacity.

"The plans, formulated by the engineers, mentioned in the last report, for the settlement of boundary rights and questions of apex, have been in operation for over a year, and all parties having any interest in the matter, have been satisfied with the results. The Tramway shaft, which has been sunk jointly by the Red Metal and the Butte & Boston companies, through which it is expected that the ores from the Minnie Healey and the Snohomish and Tramway mines will be hoisted, has reached a depth of 1400 ft. below the surface and is now being sunk to the 1500-ft. level. Crosscuts from the lower levels of this shaft are now being driven into the contiguous territory, and the orebodies developed have been most satisfactory.

"The Washoe smelter at Anaconda has been equipped with electric power, thereby greatly lessening the cost of operation, and is able to treat 10,000 tons of ore per day without difficulty. The Boston & Montana Company has throughout the year diligently prosecuted the improvements in its reduction works at Great Falls. All of the grading for the flues and dust chambers has been finished; and the new stack, the top of which when completed will be 506 ft. above the foundation, has been built to a hight of about 50 ft. The usual amount of development work in the different properties has been carried on throughout the year, and the results in most cases have been gratifying.

"The continued occurrence of high-grade ores in the lowest levels of the mines, controlled by the Amalgamated company, and in the adjacent mines of other companies, tends to confirm the confidence, which the company's engineers have always had in the future of the Butte district.

"The sawmills of the Big Blackfoot Milling Company were operated to the extent required to meet the demand of the mines at Butte and the commercial trade generally. Some decrease in output was made necessary on account of the curtailment of ore production at Butte and by reason of the fact that the demand for commercial lumber fell off materially during the financial depression. The company has confined its operations to the timber areas adjacent to its original mill sites. Its largest timber holdings still remain intact. The earnings for the year were quite satisfactory and the output of its mills is now normal.

"The Belt mines, owned by the Anaconda Copper Mining Company, and the mines of the Diamond Coal and Coke Company were operated with satisfactory results, notwithstanding the fact that during a portion of the year the demand for coal greatly diminished. Constant development work has been kept up throughout the year on the coal property, located at Bear Creek, Mont., and owned by the Washoe Copper Company, and the mines which have been opened have been for several months producing most satisfactorily. The quality of the coal is excellent and the field is one of great promise.

"The five-year labor contract, which was entered into between the employees of the different departments and the officials of the mining companies, has worked satisfactorily."

The Iron Ore Industry in Alabama

By Eugene A. Smith*

The iron ores of Alabama in the order of their economic importance are (1) red ore or hematite, (2) brown ore or limonite, (3) gray ore, and (4) black band and clay iron-stone. Until very recently only the first two have been mined on a large scale. These ores are used in the manufacture of pig iron for foundries, mills and pipe works, and for making basic iron for the open-hearth steel plants. As a rule they are too high in phosphorus for making bessemer steel. Practically all the ore mined in Alabama is smelted in the State, the shipments out of the State being about equal to what is received from other States.

Alabama stands third in the production of iron ores and fourth in the production of pig iron. The production of iron ore in 1907 is not yet accurately known, but the production of pig iron was 1,686,674 tons of 2240 lb. In 1906 it took 2.49 tons of iron ore to make one ton of pig iron, and using this proportion for 1907, the production of iron ore would be about 4,198,324 tons. Approximately three-fourths of this was hematite and one-fourth limonite.

There are 44 coke furnaces in the State, 31 of which were in blast on July 1, 1907; 5 charcoal furnaces were also in operation.

Red Hematite Ore

Red hematite, the most important ore of iron in the State, occurs in beds of varying thickness and of varying degrees of

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purity, in the Red mountain ridges which are found usually on both sides of the long, narrow valleys lying to the northwest of the Coosa valley, as in Wills', Murphree's, Jones', and in some small degree in Cahaba valley. The ore is very unevenly distributed along these ridges, being at some points near Birmingham over 30 ft. in thickness, but dwindling down to inconsiderable dimensions both toward the northeast and the southwest. Similarly, the red-ore ridges on the two sides of the valleys are seldom of equal value. The main localities along the Red mountain ranges where the ore is mined are in the vicinity of Birmingham and Bessemer, where for several miles mining operations are practically continuous. Here the ore is also at its thickest, being in places over 30 ft. thick, though at this time only about one-third of it is mined, the rest being too high in silica. In time, however, and probably at no distant date, the whole immense bed of ore will be utilized, since experiments carried out some years ago by Dr. Wm. B. Phillips, for the Tennessee Coal and Iron Company, have practically demonstrated that these low-grade ores can be so far freed from silica, by means of the Wetherill separator, as to make them available for furnace use. Two other seams, the Irondale, below the Big seam, and the Ida, above it, have been worked on East Red mountain from Birmingham toward the northeast for a number of miles.

Another important center of red-ore production is about Attalla and Gadsden. Operations occur at intervals between Springville and Attalla, and all along Wills' valley, from Attalla to the Georgia line, and also east of Lookout mountain, at Round mountain and near Gaylesville.

Near Dudley, on the Alabama Great Southern Railway in Tuscaloosa county, a fine bed of red ore has been developed by W. P. Pinkard. This is the most southerly point at which this ore is mined in Alabama. The bed here is some 9 ft. in thickness.

Borings in Shades' valley have revealed the presence of the bed of red ore below the surface, at depths varying with the distance from the outcrop on Red mountain. The quality of the ore as shown by these borings is substantially the same as that of the hard ore mined by the various iron companies. The quantity of this ore available for future use is thus shown to be enormously great. Though a certain portion of the brown ore is always desirable, and so far as I am aware, always added in making up the furnace burdens, some of the furnaces in the Coosa Valley region, Shelby, Ironaton, Tecumseh, Rock Run, etc., use the brown ore exclusively.

The red ore is now, and probably always will be, the main dependence of the ironmakers of the State.

Gray Ore

In previous reports this ore has been referred to as gray ore, or magnetite, because in many places it contains a notable quantity of magnetite. As a matter of fact, however, the magnetite will average perhaps, not more than 3 per cent. of the iron contents of the ore, which is mainly a hematite. The ore occurs in the upper part of the Weisner formation in the southern part of Talladega county; but on the mountain, near Columbiana in Shelby county, there is a bed of red ore, or hematite, which apparently occupies the same geological horizon.

The ore occurs in two seams, in some places apparently in four, varying in thickness from 1 to 15 ft., but local disturbances often make a much greater thickness. The ore is in two forms, sometimes massive and including numerous quartz grains, sometimes much softer and more slaty, and often fibrous, breaking up on weathering into fragments that resemble chips of wood. The softer ore has a higher percentage of iron. The following is the average of about 50 analyses of this ore: Silica, 20.4 per cent.; iron (metallic), 48; phosphorus, 0.3; sulphur, 0.3; manganese, 0.5; titanium, 0.3.

At the present time only one company, the Gray Ore Company, is actively engaged in mining this ore. One of the mines is at the point where the mountain range holding the ore is cut by Emauhee creek; the other, where it is cut by Tallassechatchee creek. In the past some mining was done at Columbiana, Andeluvia mountain, Wewoka Hills, and near Heacock's and Riser mountains. The recent reports from the furnacemen who have given this ore a thorough trial are very favorable. The cost of mining would be slightly greater than in the case of the Red mountain ore, but on the other hand, the average percentage of iron in the gray ore is higher.

Brown Hematite or Limonite

This most valuable ore of iron is found in largest quantities in Coosa, Murphree's and Jones' valleys, though important deposits also occur in the Tennessee valley, notably in the vicinity of Russellville, in Franklin county. Some of the most important of these ore banks are to be found about Baker Hill, Bluffton, Rock Run, Langdon City, and other points in Cherokee county; near Piedmont, Jacksonville and Anniston, in Calhoun county and at Talladega and Ironaton in Talladega county; near Shelby and Montevallo in Shelby county; about Tannehill and Woodstock near the border of Jefferson, Bibb, and Tuscaloosa counties; and near Oneonto in Blount county. This ore has been worked at the places named, and there are numerous other localities where it is known to occur in quantity, though it is as yet undeveloped.

Tantalite and columbite are the most important minerals of tantalum.

Chronology af Mining in May

May 4—Southern pig-iron manufacturers agree not to reduce prices. Drop in Montgomery-Shoshone stock is explained by an official statement that the ore at depth had proved disappointing.

May 6—The price of silver drops to 52c., the lowest point in years.

May 8—The collapse of pig-iron selling association in the eastern United States is officially announced.

May 9—The Ohio Oil Company purchases the holdings of the Superior Oil Company.

May 11—The smelting works of the Douglas Copper Company at Fundicion, Sonora, Mexico, is put into regular operation.

May 12—The British Columbia Copper Company resumes operations after six months' idleness.

May 13—White House conference of governors and other prominent men to consider conservation of national resources is opened.

May 15—The United States Steel Corporation begins the operation of its slag cement plant on the Monongahela between the Homestead and Duquesne mills.

May 19—The Neversweat mine of the Anaconda group of the Amalgamated Copper Company resumes operation affording employment for 500 men.

May 21—A bill to establish a bureau of mines in the United States Department of the Interior is passed by the House. The Anaconda Copper Company reports a deficit for 1907 of $2,921,780.

May 22—Large tonnages of pig iron are reported sold in Chicago. Steel manufacturers again agree to maintain prices.

May 28—Heavy sales of pig iron reported in the East and Middle West. Arguments in the Calumet & Hecla-Osceola case are concluded at Grand Rapids, Michigan.

May 29—The North Butte Mining Company resumes the payment of dividends, declaring a dividend of $1 per share.

According to the *Mining Journal*, May 2, 1908, an important discovery of nitrate of soda has been made on the Grampas station, Australia. The mineral is reported to be found, as in Peru, beneath a cap of guano. Samples assayed have given the satisfactory result of 24 to 29 per cent. of nitrafe of ammonia. A leading expert states that the samples inspected by him constitute the best he has seen of the crude material. The commercial nitrate of soda, it was explained, contains about 95 per cent. of pure nitrate of soda, or about 15.5 per cent. of nitrogen, which, if calculated as ammonia, would equal 19 per cent. The question still to be solved is whether the deposit is sufficiently large for commercial purposes.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Cadwallader Evans, Jr., of Pittsburg, has sailed for Dutch Guiana.

Geo. Laird, of Smith & Laird, has returned to Bisbee, Arizona, from New York.

W. de L. Benedict has returned to New York from a trip to California on professional business.

Jean Galmot has returned to French Guiana to examine placer deposits on the Marowyne river.

Gaylord Wilshire has returned to New York from British Guiana, after visiting mining properties there.

J. W. Miller has returned to New York from making a mine examination at Urique, Chihuahua, Mexico.

R. Alvin Weiss, New York, has gone to Montana, where he will be engaged for some weeks in examining mines.

J. E. Spurr and J. H. Farrell, of Denver, are making a geological survey of the Camp Bird, Ltd., at Ouray, Colorado.

Philip Reade Bradley sailed from New York, May 25, for British Guiana, to visit the Peters mine, of which he is general manager.

Herbert Haas, metallurgical engineer, has returned to San Francisco, after an extended trip through Arizona, New Mexico and Mexico.

Eugene Coste, of Toronto, Canada, and consulting engineer for the Canadian Pacific, has been in Mexico examining the oilfields in eastern Chihuahua.

H. F. Hendrie has resigned his position as general manager of the Esperanzas Mining Company, El Oro, Mexico, and returned to the United States.

Chas. M. Howbert has resigned as general manager of the Cieneguita Copper Company, Cieneguita, Sonora, Mexico, and has returned to his home at Colorado Springs.

H. W. Catlin, president of the Magdalena Smelting Company, of Oaxaca, Mexico, has returned to New York, after several months at the company's properties in Oaxaca.

J. B. Empson, consulting metallurgist to the Guanajuato Development and other companies, has established an office as metallurgical engineer in the Calle de San Francisco, City of Mexico.

A. F. Holden, of Salt Lake City, Utah, and F. Lyon, of Kennett, Cal., both of the United States Smelting, Refining and Mining Company, are in Mexico on an examination of the company's interests.

William A. Heywood has opened an office as consulting metallurgist in copper at No. 4 Broad Street place, London. He sailed for Chile, May 21, to visit the Copiapo Copper Company's plant, at Copiapo.

C. H. MacMahon has been appointed assistant to G. C. Kaufman, general manager of all the Guggenheim and American Smelting mining interests in Mexico. His headquarters will be at Velardeña, Durango, Mexico.

Leon Dominian and E. Percy Smith have formed a partnership under the name of Dominian & Smith, for the purpose of carrying on a general consulting mining business. The address of the firm is Apartado 3021, City of Mexico.

Prof. William S. Hall, of Lafayette College, Easton, Penn., expects to sail for Europe shortly to join Prof. Charles L. Bryden in order to make a professional trip through some of the mining districts on the Continent and in Great Britain.

Charles E. Finney and Edward W. Brooks have formed a partnership under the name of Finney & Brooks, to carry on a general consulting business. H. R. Simpson is associated as special partner. The office of the firm is in the Security building, Los Angeles, California.

A dinner is to be given to Prof. Robert H. Richards at the University Club, Boston, June 6, in recognition of the great service rendered by him in his 40 years of teaching at the Massachusetts Institute of Technology. The dinner is tendered him by graduates of the Institute.

Obituary

John Muirhead, who died in West Pittston, Penn., May 19, was born in Scotland 63 years ago, and came to the United States when a young man. After some years in Indiana he settled in the anthracite country in Pennsylvania, where he gradually built up a large business in the use and manufacture of diamond drills. He had done drilling for all the large anthracite companies and was well known throughout the region.

Lemuel U. Colbath died in Salt Lake City, Utah, May 26, aged 76 years. The deceased was, for many years, a conspicuous figure in the mining camps west of the Rocky mountains, Utah and Nevada being his principal fields of labor. He was identified with the Ontario mine at Park City as an engineer from the time of the organization of the Ontario company in the early '70s up to a few years ago. The remains were interred in Mt. Olivet cemetery, Salt Lake, under Masonic rites.

George P. Andrews, general manager of the Hero Mining Company, of Joplin, Mo., was drowned in the old Badger mine west of Joplin, May 24. He was exploring the mine in a boat, with C. W. Wycoff, superintendent of the Hero company, and James Roach, when the boat upset. Mr. Andrews was drawn under and drowned, the others having a narrow escape. Mr. Andrews had brought the Hero up from a losing venture to a dividend payer, and had done much to develop the sheet-ground district west of Joplin.

Societies and Technical Schools

American Foundrymen's Association—The annual convention is to be held at Toronto, Ont., June 8-11. Headquarters will be at the King Edward Hotel. Richard Moldenke, Watchung, N. J., is secretary.

Michigan College of Mines—The board of control of this college has closed a contract for a new building, to cost $50,000. It will be used for the library and museum. The main building will be 132x49 ft., with a wing 62x43 ft. It is to be built of brick, trimmed with sandstone.

American Institute of Chemical Engineers—The committee appointed at Atlantic City last June to consider the formation of an American Institute of Chemical Engineers has found (after obtaining the votes of the chemists of this country) that there is a strong sentiment for bringing together into closer relationship those men who specialize in chemical engineering. A decisive vote has been received in favor of the formation of the society. It has been determined to call a meeting for the purpose of organization. This will be held at the Engineers' Club, 1317 Spruce street, Philadelphia, June 22, 1908. As the outcome of the views expressed in response to the circular letters, and at subsequent meetings, it seems probable that membership will be established on the basis of extent of practice in chemical works or in technological applications of chemical principles on a large scale. W. M. Booth, Syracuse, N. Y., is secretary of the committee.

University of Tennessee—The announcement of this institution at Knoxville for 1908-9 says that the school of mining and metallurgy occupies all of the first floor and basement of the building formerly used by the agricultural department. The basement will contain the ore-dressing laboratory, which at present is furnished with a laboratory jig designed to illustrate practically all problems likely to arise in the treatment of an ore or coal on a jig. There is also a small laboratory crusher, and an abundant supply of screens, pans, vanning plaques, scales, etc. Space is provided for the storage of large samples of ore. The first floor will contain the assay laboratory, supplied with coal, coke and gas furnaces, and all necessary appliances; drafting room, departmental library, lecture room, museum, and office. The school of geology and mineralogy will occupy the second story of the same building. The museum of geological, mineralogical, and paleontological specimens is located in Carrick Hall.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Goldfield, Butte, Salt Lake City, Denver, San Francisco and London

REVIEWS OF IMPORTANT EVENTS

San Francisco

May 27—At a meeting of the executive committee of the Anti-Debris Association at Sacramento, California, this week, it was decided to prosecute all persons mining by the hydraulic process in the drainage basin of the Sacramento and San Joaquin rivers, whether or not they had licenses or permits from the California Débris Commission. The committee received reports also from its agents that one of the dredge mining companies at Oroville, Butte county, was not keeping its agreement with the association in the matter of landlocking its dredge. From this it may be seen that this association is bending its efforts to stop hydraulic mining entirely, and dredge mining also where it can do so.

The Bucket Gravel Mining Company has incorporated at Marysville, Yuba county, and has ordered machinery to work a large tract of land along the Feather river three miles south of Oroville. Buckets running on cables will carry the gold-bearing gravel to sluice-boxes, where the separation will be made. While the process is slower than that of the dredge, enough dirt can be handled in a day to bring returns. Should the property yield sufficient returns a dredger will be installed later on.

The new dredge for gold mining at Cash Rock in Placer county has opened a pit through the tailings nearly to bedrock. This is a suction dredge in which small rock, sands, etc., are drawn up through the pipe, while the large boulders are raised by grappling hooks which are attached by the divers, and dumped at the rear of the boat. The sand and smaller boulders are sucked up and dropped upon grizzlies through which the sand drops into boxes, which are arranged in tiers and move around in nearly a circle so as to give time and space for catching the gold. The boulders pass on over the grizzlies to an endless belt which carries them to the stern of the boat, where they are dumped into the river. Two divers are employed, who are dressed in regular diving suits. Several pieces of heavy river-washed gold have been found in the boxes.

At the Jenny Lind gravel mine near Grass Valley, the 10-stamp mill to crush the cemented gravel has been started up. The gravel channel was struck several weeks ago. The discovery was made only after three years' labor in driving a tunnel into the hill. The company has a large increase and a wide and deep channel. The gravel is strongly cemented together, hence the necessity of a milling process. This mine was operated for several years as a quartz proposition, but did not pay. Then the search began for gravel. The channel is traced for several miles to the west of the property, and on the same lead the Posey cañon is operated to good advantage.

The Balaklala Copper Mining Company, Shasta county, has resumed operations with a force of 30 men, and ore is being taken out for the smelting plant at Coram. R. N. Bishop is superintendent of the mine.

The Union Oil Company of this State, the largest of the oil corporations, has increased its capital stock from $10,000,000 to $50,000,000 and this step is to be followed by a general extension of operations in the pipe-lines, refineries, tanks, wells, wharves, shipping facilities, etc.

A new company has been incorporated at San Jose, to develop properly the old Guadalupe quicksilver mine a few miles from that city in Santa Clara county. Years ago the property was a large producer and it was subsequently in litigation for a long time. Then it was partly reopened, but there was not enough money forthcoming. The new company intends spending a large sum in prospecting and development work.

The Monterey Gold Mining Company is trying a new machine, invented by Mr. Huelsdink, of Jolon, Monterey county, intended to work the black sands so abundant in that section, not only at Jolon, but at King City and San Lucas.

The new gold camp in the San Jacinto mountains, six miles west of Indio, Riverside county, is turning out some high-grade gold ore carrying a good percentage of copper. This is the camp which was first populated by the fruit growers of the Coachella valley, the news of the original strike causing much excitement. Since then all the territory worth having has been staked out, and the locators are getting down to earnest work. The surface rock has in places shown very rich croppings, and in some instances sensational values have been encountered.

The upper levels of the old Sierra Buttes mine, at Sierra City, are yielding good milling quartz, and in the face of No. 9 tunnel, which is nearly 8000 ft. long and about 3000 ft. below the croppings, promising ore has again been found. The mine was for years worked by an English corporation which finally quit, and Hayes Brothers, of San Jose, Cal., are now operating it.

Men from Honolulu, H. I., are backing C. L. Stokes, of Berkeley, Cal., in opening the Celina group of claims in Washington district, Nevada county, and a tunnel is being driven to cut several ledges. Upraises will then be made on each ledge to the surface. Another tunnel will then be started lower down. Considerable work had previously been done on these claims. These Honolulu men have been operating successfully in the State of Nevada, but this is their first venture in this State.

Boston, Mass., men under the name of the American Mining and Smelting Company have taken under bond the old Jerry Watts gravel mine near Camptonville, Yuba county, and are putting up buildings preparatory to beginning work. The old 1400-ft. tunnel will be abandoned and a new bedrock tunnel, somewhat shorter, will be cut. The gravel is not cemented, so it can be sluiced and no mill will be necessary.

Goldfield, Nevada

May 26—The most notable news of the week has been the death of Governor John Sparks at his home in Reno. All of the flags in Goldfield have been at half-mast save that of the Miners' Union hall, which was hauled from half-mast to the mast head by some of the radicals who later built a big bonfire on the malapai.

The arbitrators in the suit between the Consolidated and the Mohawk Combination Leasing Company have handed in a decision in favor of the Leasing company, finding that the Consolidated was wrong in forfeiting the lease and thus depriving the leasers of the last four days of their contract. The arbitrators in their finding declare that the leasers shall have until 7 a.m., Monday, June 1, in which to clean up the old workings, repair machinery and get the lease into workable shape and that after that time the leasers shall have four additional days in which to extract ore for their own account. This finding is final and is not subject to review by the court. The leasers expect to take out over $50,000 during the four days. The arbitrators were T. D. Murphy, E. R. Collins and E. D. Thompson.

Arthur Weber who was arrested recently, together with his brother, for embezzlement in connection with various mining promotions, but against whom the indictments were quashed has brought suit

for $50,000 against Thos. F. and George A. Manning, of the Registration and Trust Company for false arrest and defamation of character.

Salt Lake City

May 24—At the annual meeting of shareholders of the Silver King Coalition Mines Company, the retiring officials were reelected. The treasury of the organization contains a surplus of about $200,000. Dividends were suspended last autumn, at which time production was reduced to the minimum. Development has progressed steadily, however, and physical conditions are said to be better than they have been for some time. David Keith is president of the Silver King, and Thomas Kearns, of Salt Lake, manager.

The annual meeting of shareholders of the Ohio Copper Company has been called to take place in Portland, Maine, June 3. Information comes from a reliable source that F. Augustus Heinze will not be reelected to the presidency; that while he still retains a large stock interest in the enterprise, he has relinquished a control of the stock. While details of the arrangements have not been released, it is said under the new order of things the company will have at least $1,000,000 with which to complete the 2000-ton concentrating mill at Lark, and to place the mine on a productive basis.

Butte

May 28—There has been a steady increase in the interest shown among mining men in new properties around the camp during the past week. Several parties of Eastern capitalists have visited and examined the district. The Parrot company continues its development work on the Little Mina. Pittsburg & Montana is pushing the work on its new 300-ton concentrator, which it soon hopes to use for the treatment of its lower-grade ores. It is reported that negotiations are being carried on by certain London mining men, with a view to securing control of the Carlisle and Protection claims for an English syndicate. These claims, as yet but little developed, are situated in the North Butte district, just south of the Butte & Superior. The Anaconda Copper Company has installed on the Modoc mine a new single-drum electric hoist, with a 100-h.p. motor; a new gallows frame has also been erected.

Denver

May 29—The Newhouse Tunnel has its portal at Idaho Springs at an elevation of about 7500 ft., and was destined to tap the mines of the towns of Black Hawk, Central City, Russell Gulch and Nevadaville, the altitude of which are about 9000 ft. above tidewater. The tunnel is now in 17,740 ft., and was closed down some time ago because, having passed through a long, barren section, it was now approaching the heart of the richest portion of the district, which it would drain, and the owners did not appear willing to remunerate the tunnel company for taking the water of their mines.

Now, however, an agreement has been reached, by which the tunnel will be driven a further 5000 ft. at the rate of 150 ft. per month, making the total length over four miles, and draining all the mines at an average depth of 800 ft. below their lowest workings. This will open up a new era of production for these Gilpin county veins, which, as proved by the workings of the California mine and others, retain their size and values to a depth of over 2000 ft. The basis of the agreement is 25c. per ton for all the ore mined and hoisted to the surface through the present shafts, this being practically a drainage charge. If brought to the surface through the tunnel, however, an additional charge of $1 per car of a cord (eight tons) will be made. About 65 per cent. of the mines have already signed the agreement, and there can be little doubt that all will readily agree to such an eminently reasonable arrangement. This next 5000 ft. will give to the mines additional backs of an average of 800 ft. without pumping and, when connection is made with the tunnel, without hoisting.

The latest episode in the somewhat romantic history of the Matchless mine of Leadville is that the widow of the late Senator H. A. W. Tabor has just paid off the last instalment due on the mortgage of $30,000, and is now in possession of the mine. Tabor paid $117,000 for it in 1879. He sunk a shaft on it, and within a few feet struck the orebody, from which he eventually took millions; but he lost his fortune, and at his death, the mine passed to his widow, who, with her two daughters, has lived at the mine in comparative poverty for some years, refusing admittance to the mine, and all offers of purchase or lease. It is said now that Mrs. Tabor has granted a lease to the friends who furnished the money to lift the mortgage, and that this once great mine will now be reopened.

London

May 22—A short time ago, in 1905 or 1906, the public were invited to invest in Siberian gold properties, from which astonishing profits were to be realized. Promoters of companies were not slow to point to the enormous extent of the country and the wide area over which gold was reported to have been found. Here was a neglected El Dorado which the new Siberian railway now made accessible. The difficulties of communication had so far prevented the wealth of the country from being exploited, and it was further explained that local capital could not be obtained because the savings of the people had been swallowed up in paying the expenses of the Russian-Japanese war. The British public had, therefore, according to these gentlemen, an admirable chance of acquiring most valuable properties on most favorable terms. Those who were attracted by this sort of argument have now good reason to regret it. Judging by the prices of Siberian mining companies and by the report of the Siberian Proprietary Mines, Ltd., one of the prominent companies formed to exploit the riches of Siberia, the profitable nature of gold or other mining in that country has been much exaggerated. A more deplorable report than that lately issued for the period Dec. 1, 1906, to Jan. 13, 1908, it is difficult to imagine. The profit and loss account shows a loss of $421,085, chiefly accounted for by the heavy depreciation in the market value of the company's holdings in Troitsk Goldfields, Ltd., and Orsk Goldfields, Ltd., two companies for which the Proprietary company was responsible. As regards the Troitsk company the directors' report has something encouraging to say. A 5000-ton-per-month plant is to be erected with the least possible delay, and with expenses equal to 4 dwt. fine gold per ton, "a substantial margin of profit" is to be obtained. But a gloomy view is taken of the Orsk property, and the fear is expressed that unless the development of the mine is more encouraging, the property, which is only held under lease with option of purchase, will be abandoned. The Proprietary company is also interested in a copper property which is said to contain over 500,000 tons of oxidized copper ore containing 2 per cent. copper, which has no value at present. Hopes are entertained that when the sulphide zone is reached payable ore may be met with.

The heavy losses that the public may have experienced in these undertakings will be evident from a comparison of the prices of the shares in 1906, and what they stand at now. Siberian Proprietary shares were as high as £16 10s. in 1906, and on May 11, 1908, the price was £1 7s. 6d. When the capital of the company was increased in 1906 the £1 shares were offered to the shareholders at a premium of £11 10s. Orsk Goldfields in 1906 were as high as £2 15s., and on May 11, 1908, could be had for 15d. Troitsk shares have also had a tremendous drop, being £1 15s. in 1906 and 8s. 9d. in May, 1908.

The high prices to which the shares were raised were no doubt influenced by the fact that the directorate contained the names of men of established character and position. What these gentlemen think of the business may be guessed from the statement in the report that several of them have resigned from the board. The general meeting of shareholders is to be held next week and it will be surprising if the shareholders do not ask for further information as to how such disastrous results have come about, and for an explanation as to the retirement of so many directors whose names rightly carried the confidence of the shareholders.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

General Mining News

Amalgamated Copper Company—At the annual meeting in New York, June 1, John Bushnell, John D. Ryan and Benjamin B. Thayer were chosen directors, to succeed George H. Church, J. E. Judson and James Stillman. All of the new directors have been connected with the company for some time in various capacities. The statement for the year will be found elsewhere.

United States Smelting, Refining and Mining Company—The second annual report of this company shows a profit for the year 1907 of $2,070,214. The consolidated companies produced 38,518,378 lb. copper; 53,617,324 lb. lead; 6,739,269 oz. silver, and 235,822 oz. gold. Dividends distributed amounted to $2,850,528, leaving a surplus of $557,003 undistributed.

Alabama

JEFFERSON COUNTY

Tennessee Coal, Iron and Railroad Company—With the resumption of operations at the steel plant and two furnaces at Ensley, this company will also start up in the Pratt field four coal mines, three washers and 700 coke ovens. This will increase the coke production 25,000 tons per month, and coal output 19,000 tons, besides that sent to the coke ovens, or about 57,000 tons in all. The mines will start early in June, giving employment to about 1500 men. The company has just completed two casting machines at the Ensley furnaces; also large steel storage bins for coal and coke. The coke bins are furnished with screens, and with an elevator and conveyer plant to collect the breeze from the coke, and load it in railroad cars.

Alaska

KETCHIKAN DISTRICT

Cymru—A hoist, pump and six drills have arrived for this property at Baldwin. Buildings are ready for them, and work is to be begun at once. The mine is said to be showing well in copper ore.

Redwing—This property has been sold to a new concern, known as the Seattle-Alaska Copper Company. Mining machinery has been ordered.

It Mining Company—This company has completed the purchase of the It and some adjoining claims on Kasaan bay, and will begin work on their development at once. A crosscut made by the original owners has shown some good copper ore, carrying gold also.

Spokane-Alaska Mining Company—This company, which has taken over the Sanford and other copper claims at Dall Head, is preparing to begin active work. The shaft is to be sunk 200 ft. and other development work done. William Newton, of Spokane, Wash., president of the company, is in charge.

Arizona

COCHISE COUNTY

San Pedro—This mine, under lease to J. G. Alexander and associates, is shipping high-grade ore at the rate of three carloads a month.

Nacozari Consolidated—The adit recently begun on this mine is under cover 200 ft. Crosscutting has commenced for the vein, which may be encountered at any time. The ore is very similar to that of the San Pedro.

Bella Union—This mine, situated in Pilares district, belonging to the Phelps-Dodge interests, has been taken over by Emory Bell, of Douglas, and work is already being prosecuted. The mine has produced high-grade copper and will be a shipper from the start.

Devore—Ore of a good grade has been struck on this property. It is situated in San Pedro district and lies southeast of the San Pedro mine.

Comanche Chief—Miners are at work in the adit of this mine in Paradise district. On this property there is a 50-ft. shaft, the bottom of which is in ore. This mine is one of a group of 40 claims belonging to Capt. John A. Duncan.

Willie Rose—While sinking a well for water a rich vein of ore was encountered on this property in Paradise district. Further development is showing an increase in the value of the ore.

Santa Rosa—Drifting on this property situated in the Douglas district, is now in 248 ft. No. 3 shaft has reached a depth of 300 ft., and small pockets of ore have been found in leached iron formation.

Twin Buttes—This mine is shipping four carloads or 200 tons of ore weekly. Shipments will be increased next month.

Five Points—This property, situated in Pinto creek district, is in ore in all its workings. At the 200-ft. level drifting has been forwarded 500 ft. in ore. The ore is sulphide.

Powers Gulch Development Company—This company recently struck a good body of sulphide ore at a depth of 60 ft. The ore is now being shipped to the Old Dominion smelter at Globe.

Pinto Creek Copper Company—A 100-ton concentrator is being installed on the mines of this company and work in the mines is suspended while the new machinery is being erected. The rock is porphyry, and there is a large area of low-grade ore. There are more than 2000 ft. of development work in the mine.

Globe Standard—This property in Power's gulch is in operation. The copper-zinc ore carries some gold and silver. All the orebodies are in porphyry, the ledge pitching to the northwest.

Centennial—This mine, which is owned by the Old Dominion smelter, of Globe, is shipping about 60 tons of ore a day. The ore is of a silicious character, carrying gold, silver and copper. A new orebody was broken into on the 500-ft. level.

Castle Dame—This mine, on the east side of Pinto creek, is working vigorously, with a great deal of development work done and good orebodies in sight. The deepest working is 300 ft. in schist and diorite.

Calumet & Globe—This company is devoting much time in sinking a two-compartment shaft to a depth of 300 ft. From this level a crosscut will be run to tap the ledge in a new place. The ore contains copper chiefly.

PIMA COUNTY

Home—W. F. Westbrook is extracting ore from a rich ledge on this group of claims situated in Pinto district. The vein was struck through a 100-ft. adit.

Big Four—J. Ryson and W. P. Greene will begin extensive development work on this property soon. The mine is situated on the Summit county road, and Tucson will be in easy access for ore shipments and the hauling in of supplies.

Warren-Parmson-Moody Company—This company, operating on Upper Pinto creek, has struck an immense ledge of chalcopyrite of copper which bids fair to develop into one of the greatest mines in the county. Since the strike of the new vein an attempt has been made to crosscut, but despite the fact that an advance of 10 ft. has been made, there is no sign of the hanging wall yet. The adit is in 220 ft., and it has a vertical depth of 200 ft. Plans and drawings have been exe-

cuted to have a tramway run into the adit, and after going through the ledge to sink, and for that purpose extra men have been employed.

Buckland & Bartlett—This company is developing its claims in Silver Mountain district, and has struck a ledge of ore that assays well in silver and copper.

Kenney Brothers—These men are opening their claims at Government Springs. The ore carries gold, copper and silver.

SANTA CRUZ COUNTY

Gringo—A new and heavier plant of machinery is to be installed at this gold mine, in the Tyndall district, and the shaft, now down 120 ft., will be sunk to the 500-ft. level. The mill will be increased from a 10-stamp to a 30-stamp plant.

Saleros—After several years of prospecting, during which a number of deep holes were bored with a diamond drill, the company, operating in the Tyndall district, is making extensive preparations for mining. The wagon road is being graded from Patagonia to the camp, a distance of 12 miles. The first work will be the sinking of a shaft on the Darwin 500 ft., and driving an adit on the Eureka. The veins to be opened are of high-grade silver and copper ore.

YAVAPAI COUNTY

Monica Mines Company—This company, near Kirkland, is installing an additional 10 stamps in its mill. The output of the mine has been far in excess of the milling capacity. The average of the ore milled during the last week averaged $23.10 per ton recovery.

DeKalb Mining Company—It is reported that this company will soon resume work on its mines near Crown King. The holdings of the company are in the Peck district. Work was suspended last October on account of the financial difficulties.

Mt. Elliot Consolidated Mining Company—A bar valued at about $4000 was shipped to the mint from the mines near McCabe. The 10-stamp mill is running one shift at present, but another shift will be started soon.

Rigby Reduction Works—The works of this company at Mayer, Ariz., will soon resume operations. A large amount of ore is awaiting treatment.

Storm Cloud—The H. J. Beemer Company, operating these mines, 10 miles south of Prescott, has increased its force and production and shipping will soon be resumed.

Williams—These mines, situated 10 miles south of Prescott, have been bonded to Philadelphia men. Work has been started and is being pushed. A large amount of high-grade ore has been extracted from these mines.

Verde River Copper Company—The last shipment of machinery for hoisting plant and air compressors has been made to the property in Cherry Creek district.

Granite Mountain—W. T. Baker has a 30-ft. ledge in this mine carrying gold, silver and copper. At present the work consists in cutting in order to get ground to work from as well as upon which to make the ore dumps.

Poland—Last week the Prescott National Bank shipped another $3000 bar of gold to the mint from this mine, being the second shipment in three weeks. The property is situated in the Poland district, 20 miles northeast of Prescott.

Eagle Mining Company—This company, whose group of mines are situated in Buckham district, has just made a new discovery of ore on one of its properties. The strike consists of a ledge from 6 to 8 in. wide of gold ore, extending for 4500 feet.

Deering Group—Wm. Anderson is developing his claim adjoining the group at Thumb Butte.

Richenbar—This mine, Richenbar district, shipped a $2000 bar of gold bullion to the U. S. mint at San Francisco last week.

California

AMADOR COUNTY

Argonaut—Since W. S. Matthews was elected president of this company at Jackson, on the resignation of W. F. Detert, a policy of retrenchment has been adopted and a number of men have been laid off while prospecting is being carried on.

CALAVERAS COUNTY

Boston—T. & J. McSorley have interested Nevada capitalists in this mine and will shortly have it in operation.

Ritter—An 18-in. vein has been struck in this claim at El Dorado, on the East belt of the Mother Lode. The streak is well defined, and was found at 140 ft. depth.

FRESNO COUNTY

A very promising free-gold ledge has been discovered near Trimmer Springs, and numbers of prospectors have gone to that locality. A small stamp mill is being put in by James Elwood.

INYO COUNTY

Empire—Bishop & Ellis have resumed work on this group southeast of Bishop, near the Black Cañon and Silver Cliff groups.

White Mountain Mining and Development Company—This company was recently incorporated, with its principal office at Fort Wayne, Ind., J. B. White, of that city, being president. The company has bonded and bought several groups of claims near Bishop—the Gem group of eight claims, and the Ivanhoe groups of four claims, in the White mountains, near Laws; and also the Rose group of four claims. Development is to proceed at once.

KERN COUNTY

Home Gold Mining Company—This company is opening a mine 4½ miles west of Rosamond, in Antelope valley, and a mill is to be built next month. A. W. Collins, of Tropico, is manager.

NEVADA COUNTY

Idaho-Maryland—In addition to the strike in the 200 level another very rich one has been made in the 500 level of this mine at Grass Valley.

Kenosha—On the 200 north level, 100 ft. from the shaft in this mine, Geo. W. Root, superintendent, very rich ore has been found.

Richland—This gravel mine on Cement Hill, Nevada City district, is to be reopened. Robt. Jones, of Newcastle, Placer county, is president.

PLACER COUNTY

Hibbe—An Eastern company has bonded this copper mine, 12 miles north of Lincoln, and will put in machinery at once.

Home Ticket—A small mill is being put up on this mine to crush the cemented gravel.

Paragon—W. S. Fletcher is cleaning out the old Breece & Wheeler ditch to bring water to this mine. It will be ground-sluiced and the old hydraulic pit used to catch the tailings.

Valley View—Under superintendence of E. Cartwright, men are cleaning out the old Taylor shaft of this mine. Re-timbering is being done as fast as the water is lowered. A new hoist has been put up.

PLUMAS COUNTY

Bonnie Hydraulic Mining Company—This company owns the Boston and Eclipse gravel claims on Poorman's creek, 22 miles southeast of Quincy, and has nearly completed its débris dam. Meantime gravel is being sluiced. There are three monitors and pipe-lines and five miles of ditch. Henry Stanislawsky is manager of the company, the offices of which are at Reno, Nevada.

Engels—Arrangements are being made for the reopening of this copper mine in Light's Cañon, by Henry Engels.

SACRAMENTO COUNTY

Natoma Development Company—The big new gold dredge at Teat's Flat, has been put in operation. Two other dredges are being built for the company, one to work at Mississippi Bar and the other at Sacramento Bar.

SAN BERNARDINO COUNTY

Dry Lake—For this property, Victor, a

new hoist and new mill are to be purchased. There is a three-stamp mill on the ground now.

Eagle City—At this new camp, 32 miles east of Victorville, some development work is now being done and the showing seems satisfactory to those directly interested in the claims.

B. B.—This property, 12 miles east of Silver Lake, has been sold to J. C. Jaxon, of Pasadena, who will at once develop the five claims of the group.

SAN DIEGO COUNTY

Escondido District—At this place high-grade ore has been found in the Bottle Peak mine. In the Cleveland-Pacific group, leasers have made the best strike in years. Escondido is 35 miles northeast of San Diego.

Boulder Creek Consolidated—Repairs on the milling plant of this company have been completed and a trial run on ore from the Cuyamaca claim is being made.

North Hubbard—The Yellow Gold Mining Company, of Oakland, Cal., W. A McNaughton, superintendent, has purchased this mine in Banner district, and will equip it with suitable machinery.

SANTA CLARA COUNTY

Guadalupe Quicksilver Mining Company—This company has been incorporated at San Jose to reopen and develop the old Guadalupe quicksilver mines in the foothills of the Santa Cruz mountains.

SHASTA COUNTY

The hull of the new suction gold dredge at Central Spur has been launched, and the machinery is being put in place.

Washington—At this mine, French Gulch, operations have been resumed.

SISKIYOU COUNTY

Black Bear—John Daggett has arranged with certain capitalists to put in new machinery and reopen this once productive property.

Grider—A hydraulic gravel elevator has been installed at this mine, Seiad valley.

Wood & Brown—The copper ledge has been struck in the lower tunnel of this mine, on Indian creek.

Homestake—At this property, H. D. Andrews, superintendent, they recently struck ore in the lower level. A mill will soon be installed.

TUOLUMNE COUNTY

Eureka—At this property, near Groveland, operated by Joseph Callahan and associates, they have purchased new machinery. In the very wide vein there is a small pay streak which is of high grade.

Eastern Star—J. M. Phelan has bought this mine near Groveland from R. M. De Ferrari.

YUBA COUNTY

Jerry Watts—This mine, near Camptonville, has been bonded by the American Mining and Smelting Company, and vigorous operations have commenced. L. C. Heller is superintendent. Boston men have control, and J. I. Martin, of this city, is manager. A new bedrock tunnel is to be run to the channel. The claim is an old one, having been worked for 35 years intermittently.

Sylvester—This gravel mine, on the middle Yuba river, is to be developed this summer by Wm. McIntyre and associates.

Colorado

Victor Fuel Company—This company reports for the 10 months of its fiscal year from July 1 to April 30, gross earnings, $2,188,030; net earnings, $490,129; other income, $66,166; total, $556,295. Charges were $125,095 for interest and $65,427 for depreciation; a total of $190,522, leaving $365,773 surplus.

LAKE COUNTY—LEADVILLE

Big Six—For several weeks development work in new territory has been carried on in this property, Breece hill, from the 700-ft. level, and recently 150 ft. from the shaft, a body of lead sulphides was opened from which 25 tons daily are being shipped to the local smelter; the ore runs well in gold and silver in addition to the lead. Present indications point to the opening of a large ore shoot.

Emmet—Lessees are working the lower drifts on this property, Iron hill, and during the week opened an excellent body of iron from which about 50 tons daily are being shipped. The iron carries silver and some lead, as well as an excess, and is a desirable fluxing ore.

Forepaugh—The shaft house and engine room on this property, Fryer hill, were destroyed by fire last fall, and little work underground has been done since. Arrangements have been made by which the property will again be worked extensively, and the new lessees are erecting new buildings and installing a new plant of machinery. When this is completed underground work will be started on the large bodies of iron that still remain in several of the lower levels.

Forest City—Lessees working at the upper levels have opened a fair streak of silicious ore, and shipments from it will begin soon. This may lead to the body of ore that was opened in the lower levels a few years ago.

Silent Friend—During the winter work has been carried on in this property, South Evans, from the 500-ft. level to locate the orebody that was supposed to exist. Recently the ore was caught in an upraise from this level and it is estimated that it is fully 60 ft. in hight; other proportions so far are unknown. The ore is a lead sulphide running well in gold and silver. Several carloads have already been sent to the smelter, but as yet the returns have not been received. Development work is being pushed to ascertain the extent of the ore.

Sunday Tunnel—The work of re-timbering and straightening this tunnel, California gulch, is now well under way. A force of men is engaged at the breast widening it out, and when this is finished driving ahead will begin.

OURAY COUNTY

Camp Bird, Ltd.—This company reports that in April the mill ran 30 days, crushing 6813 dry tons of ore, the product being 9158 oz. bullion and 328 tons concentrates. Sales of product for the month were: Bullion, $161,466; concentrates, $10,309; total, $171,775. Expenses were $51,545, leaving a balance of $120,230, from which $1500 must be deducted for London expenses, leaving $118,730 net. There were 543 ft. of development work done, and $238 spent for construction.

Mono-Baltic—A recent item relating to the Saratoga mine should have been credited to the Mono-Baltic Mining and Smelting Company, which owns the Saratoga and several other mines in Red mountain district.

TELLER COUNTY—CRIPPLE CREEK

Blue Bird—Charles M. Becker and associates, leasing this mine from the company, are stoping between the 400-ft. and 600-ft. levels, and shipping ore steadily.

Comanche Plume—Baker & Co., leasing on this mine on the western slope of Battle mountain, are stoping on a 4-ft. vein of good ore.

Dante—The British American company, leasing on this mine, is hoisting ore and shipping to the mill of the United States Reduction and Refining Company at Colorado City.

Trilby—This company's mill to treat low-grade ores will be ready to start in June. All leases have been terminated, and the company will operate the mine, which is on the southern slope of Bull hill.

Idaho

IDAHO COUNTY

Idaho Central—This company has just been organized by Spokane men to operate a group of claims in the Elk City district. The company owns four and one-half claims, on which are two veins; one is exposed by open cuts and two shafts, is 7 to 8 ft. wide, and contains gold-quartz ore, carrying free gold and tellurides. One shaft is to be sunk from the 50-ft. level to a depth of 250 ft., and work on this is to commence at once. The other vein has not been worked as yet.

SHOSHONE COUNTY

Snowstorm—Manager W. D. Greenough states that the mine will increase its output by 100 tons daily within a month, which will make a total of 600 tons per

day being shipped from the mine to six different smelters. This is the largest output of ore from this mine yet accomplished, far exceeding the best days of the copper boom. State Mine Inspector Robert N. Bell stated that the ore is being mined at a cost not to exceed $1 per ton, and yielding a good profit even at present prices. Work is still in progress on a long adit to tap the vein near water-level.

Rex—Arrangements have been completed for the resumption of work under the management of J. P. Keane. It is stated that a crew of 18 men will be put at work this week sinking the double-compartment shaft to the 650-ft. level. This will require four months to accomplish, after which it will take two months to crosscut to the vein. The mill will remain idle until this work is completed.

Monitor—This property, which was recently acquired by the Success Mining Company, will be put in operation this month, according to J. W. Bailor, of the Success company. The latter is under contract to sink 300 ft. and to drift 1500 ft. on the 400-ft. level. The mine was formerly a shipper, and sent about 200 tons of ore to the Tacoma smelter. Twenty men will be employed with the opening of the mine.

Hecla—The mine has resumed operations with 150 men. As fast as the old employees return they are being put to work, the company holding places for them. The work in progress consists of sinking from the 900-ft. level and in stoping at this level.

Indiana

GREENE COUNTY

Three hundred miners employed in the Summit mine, near Linton, refused to work under direction of a certain mine superintendent, last July and went on a strike. After remaining out for 10 days they were forced back under orders of the district president. Under the contract the striking miners were subject to a fine of $1 for each day they remained out, and this amount was withheld from their pay. All but 53 accepted their pay. The 53 brought suit to collect the money withheld as fines, and recently obtained judgments for the full amount, with penalty calling for a similar amount. The company consented to the entry. While the suit brought by the miners was in direct violation of the agreement, the agreement itself was found to be in violation of State law. It is understood that the company will be reimbursed by the district organization, the officials thereof refusing to sanction the violation of the agreement and subsequently profit by a suit at court. It is expected that more or less trouble between the miners and the district officials will develop in consequence.

Michigan

COPPER

Superior—The crosscut at the 9th level of No. 1 shaft of this property has encountered the lode which is well charged with copper. The crosscut will be extended until the hanging wall is reached when drifting will be started on the vein. The copper content continues unchanged in the upper levels and the property is gradually but surely being developed into a paying mine.

Tamarack—The management is considering the advisability of changing the method of hoisting in No. 2 shaft from the present cage and car equipment to the Kimberly-skip system, in view of increasing the rock tonnage from this shaft.

Atlantic—The company is operating four drills at its section 16 shaft and at the 12th level to the south the formation that is being opened is undoubtedly the Baltic lode, the rock being identical with the rock coming from the Baltic No. 5 shaft. The north drift from the 12th level of the Baltic No. 5 shaft, which is on the same horizontal plane with the 12th level of the Atlantic, is encountering very good rock. This drift is in 600 ft., and with the 200 ft. from the Atlantic shaft, brings the distance between the two shafts less than 800 ft. It is the intention of the Atlantic company to connect with the various levels of the Baltic and in this way afford good ventilation. In all probability a temporary shaft house will be erected and the vein rock shipped to the stamp mill for treatment instead of piling on a stock pile.

Copper Range—Sinking is going forward at the Globe shaft and a change in the formation is expected daily, because the shaft is nearing the approximated distance wherein it should encounter the Baltic lode. The amygdaloid formation encountered at a depth of 856 ft. did not show sufficient copper to warrant further opening at the present time.

Victoria—A good formation has been cut in the drift at the 22d level, the identity of which has not yet been fully established; there is a possibility of its being the Lake lode. At the exploratory shaft located 2800 ft. to the east of the present working shaft, a drift is being driven east at a depth of 140 ft. Nothing of any importance has yet been encountered.

Calumet & Hecla—The new 40-ton standard-gage rock cars have been tried out and proved satisfactory; some have gone into commission handling the rock from the north end of the mine and others will be added as soon as the tracks and locomotives are altered to meet the new conditions. Several of the boilers at the new boiler house at the stamp mills have gone into regular service and are giving satisfaction.

IRON

Antoine Ore Company—At a meeting of representatives of Oglebay, Norton & Co., Republic Iron and Steel Company and the Shenango Ore Company, it was decided to remove the pumps and allow this Menominee mine to fill with water. Development work had put the property in shape to produce a good-sized output.

Chartiers Mining and Manufacturing Company—This company expects to start drilling northwest of Iron Mountain. Test pits on the property showed encouraging results.

Newport—The new steel five-compartment shaft D has gone into operation. It is 28x7½ ft. inside measurements and is equipped on the surface with a large steel shaft house. The shaft is sunk in the footwall, work having begun in October, 1905, and has reached a depth of about 2000 ft. on a dip of 65 deg. It is intended to abandon A shaft and hoist its ore through D shaft.

Minnesota

IRON

Syracuse—Picands, Mather & Co., are installing two 2000-gal. pumps to lower the water in this mine. The present equipment is pumping 3000 gal. per min. but is not lowering the water level. So far the company has expended nearly a million dollars for its concrete shaft and its equipment and no ore has been mined. The water problem at the Syracuse is one of the most difficult on the Mesabi range.

Missouri

ZINC-LEAD DISTRICT

On account of the heavy rains, many companies are finding it necessary to increase their pumping facilities. The Tidioute Company, at Zincite, the Providence at Webb City, the Mohler-Smith at Carl Junction, the Van Auken at Belleville, and Jacobs & Co., Joplin, are among the companies putting in new pumps—mostly of the two-stage centrifugal type.

All Jack—This company at Chitwood is erecting a mill at its mine just south of the Conqueror. It has the same run of ore that was found in the Conqueror.

Garlinger Land—A drill strike has been made on the land of Charles Garlinger, three miles northwest of Carthage. The ore was found at 192 ft. depth and continuing 17 ft. down.

Merry Widow—This company, recently incorporated to open up the old Beacon Hill property on the Leonard land at Chitwood, is prospecting the tract and verifying the old drill holes. A strike has already been made in one drill hole at 134 ft. depth.

Optimo—This company, at Sarcoxie is taking up a 20-ft. stope and has a 30-ft. face of ore running about 8 per cent.

Pumpkinhead—A mill is being erected at this mine, west of Joplin and owned by Hutton & Coyne, of Webb City. The mill, which is a new one, is being moved from near the Morning Hour, where it was erected, but never run.

Vantage—This company has shut down its large pumping plant at the mine in Center Creek valley. The pumps have been kept running for some months only through the large contributions of adjacent mining companies, especially the Bull Dog. It is not yet known if the remaining mines can beat the water.

Montana

BUTTE DISTRICT.

Ida-Montana—Negotiations are being carried on for the resumption of work on this property. The shaft is down 400 ft. and previous to the shut-down a vein of commercial ore was cut on that level. The principal mineral in the vein is chalcopyrite, associated with zinc sulphide. Much water has been encountered in developing the property.

Butte-Balaklava—This property consists of two fractional claims comprising approximately seven acres, with an easterly and westerly distance along the leads of 1600 ft. Veins are being developed on the 500 and 700 levels with good results. A double-drum electric hoist, good for 1500 ft. depth and driven by a 165-h.p. motor has been in use for some months. The management states that plans are being made for the construction of a steel headframe with automatic dumping apparatus.

Davis-Daly—At the Lizzie shaft a small development hoist is being installed. The power will be supplied by an air line run from the Colorado shaft, also of the Davis-Daly, and distant about 200 yards.

Butte-Montana—An option on the controlling interest in this company has recently been secured by F. E. Slump, of New York, and an initial payment of $10,000 made. The company owns the Alec Scott claim, a fraction 500 by 375 ft., adjoining the West Colusa mine.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Production—The output of the mines and leases during the week ending May 23 was 2439 tons, valued at $21,537.50, and was handled as follows: Combination mill, 665 tons; Western Ore Purchasing Company, 1022 tons; Nevada Goldfield Reduction Company, 762 tons.

Goldfield Consolidated—An interesting and exhaustive series of tests is being run at the Combination mill of the Consolidated between the Allis-Chalmers suspended Frue vanner and the Deister slimer, the results of which will determine which type of machine will be used in the new 100-stamp mill. Work on the new mill is progressing rapidly. The foundations for the crusher plant and the sampling mill are completed and several of the concrete walls for the mill building are also finished. The forms for the battery blocks will be ready and concrete will be poured before the end of the week.

Jumbo Extension—The apex litigation between the Jumbo Extension and the Consolidated over the Gold Wedge claim, owned by the former, has not been settled, various reports to the contrary notwithstanding.

St. Ives—The Codd lease on the St. Ives has struck a vein of as yet undetermined dimensions on the 522-ft. level. An assay of the muck gave $5.20, but assays of the clean ore gave from $188.80 to $358.80 per ton. A great deal of money has been spent on this lease and considerable rich ore was taken from the upper levels before the vein faulted.

Florence Consolidated—This lease is shipping steadily ore running over $100 per ton. New development work is being pushed.

C. O. D. Consolidated—The Victor Leasing Company has made an important strike, assays from the hanging wall giving returns of $25 and from the footwall $175 per ton. This is of especial interest as almost without exception, heretofore, Goldfield veins have been richer on the hanging-wall side. This ore contains a considerable percentage of copper.

NYE COUNTY—BULLFROG

Little Lee—In addition to the lease let to Elmer Kane and Ed Kelton, another lease has been granted Harry Clark and associates. Both sets of leasers have started development work.

Keane Wonder—A clean-up covering 7.3 mill days last week yielded a 300-oz. bar of bullion, valued at $5000.

Tramp Consolidated—Superintendent Garden continues to sack ore for shipment in the drift between the Tramp and Eclipse shafts.

NYE COUNTY—TONOPAH

Ore Shipments—The total output of the Tonopah mines for the week ending May 23 was 6110 tons, of an estimated value of $127,400. The ore shipments over the Tonopah & Goldfield Railroad to the Western Ore Purchasing Company, consisted of 130 tons from the Tonopah Extension. The Tonopah company sent 3450 tons, the Belmont company 940 tons, the Montana-Tonopah 1100 tons, the Jim Butler 240 tons, the Midway 100 tons, and the MacNamara 150 tons to the mills.

Montana-Tonopah—The south crosscut on the 300-ft. level last week encountered a body of oxidized milling ore about 3 ft. wide 88 ft. south of the MacDonald vein. It appears to be a new vein, but may be an extension of the oxidized orebody on the level below.

Mizpah—All the preliminary work has been finished and sinking of the shaft to lower levels has begun. An air hoist with a capacity of 600 ft. has been installed on the 900-ft. level and will be used in sinking to the 1300-ft. level. The mill crushed 3036 tons of ore of an average value of $20.50 per ton. The week's shipments included 57 bars of bullion and 44 tons of concentrates, of a total value of $72,500. Extraction was about 90 per cent.

Tonopah Extension—The orebodies recently cut on the 600-ft. and 550-ft. levels continue to yield milling and shipping ore. A carload of ore broken from the 550-ft. level and shipped to the sampler of the Western Ore Purchasing Company averaged 1.25 oz. gold and 114.2 oz. silver.

Ohio

BELMONT COUNTY

Number Eight Coal Mining Company—This company has been organized to develop a large tract of coal land, and to build a short railroad to connect the mines with other roads. L. B. Landmesser, C. S. M. Krumm, W. H. Hann, Franklin Neff and B. G. Huntington, of Columbus, Ohio, are incorporators.

Oklahoma

COAL COUNTY

Prospecting of the unleased segregated lands by the United States Government is progressing rapidly. The last Congress appropriated $50,000 for this work, to determine their value and extent, so that some disposal might be made of what remains. Two Sullivan diamond drills are being used, which take out a 2-in. core. One has a capacity of 800 ft., the other 1500 ft. The drills are now operating near Coalgate.

PITTSBURG COUNTY

Rock Island Coal Mining Company—This company has under construction a briquetting plant at Hartshorne, intended to briquet its own slack; this is the first plant of the kind in this district.

PUSHMATAHA COUNTY

Choctaw Asphalt Company—This company is opening up a new asphalt mine near Tuscohoma. That section of the State promises to be an important producer of this mineral.

TULSA COUNTY

Mohawk Mining Company—A 30-in. vein of coal, with an 18-ft. cover, is being successfully stripped by this company; steam shovels and derricks are used.

Pennsylvania

ANTHRACITE COAL

Philadelphia & Reading Coal and Iron Company—This company's statement for

April and the 10 months of its fiscal year from July 1 to April 30 is as follows:

	April.	Ten Mos.
Earnings	$4,453,707	$32,861,571
Expenses	4,250,573	30,600,877
Net earnings	$ 203,134	$ 2,260,694

For the 10 months there was an increase of $851,110 in earnings; an increase of $280,997 in expenses; and a gain of $570,113 in net earnings.

Philippine Islands

Benguet Consolidated Mining Company—This company reports its production for the month of March at 105 oz. and 60 lb. of cyanide bullion, containing about $1500 in gold.

West Virginia

MARION COUNTY

Federal Coal and Coke Company—It is reported that this company's property, 12 miles south of Fairmont, has been sold to the New England Gas and Coke Company, of Boston. The sale includes 5500 acres of coal land, upon which one mine is now in operation. It is said that the purchaser will make extensive improvements, with a view to increased production.

Wyoming

ALBANY COUNTY

American Gold Placer Mining Company—This company operating on Douglas creek has installed a dredging machine, and is preparing to begin operations at the earliest possible moment.

Wisconsin

ZINC-LEAD DISTRICT

Eastern interests, affiliated with the American Zinc, Lead and Smelting Company, are effecting a consolidation of a number of the producing mines in the Platteville camp. At meetings held this week the Empire, Acme, Royal and Mitchell Hollow companies voted unanimously to come in. Other companies will hold meetings soon to consider the proposition offered them, and it is likely that several more mines will be included in the consolidation.

Aragon—This company obtained and is removing the mill equipment of the Snowball.

Canada

ONTARIO—COBALT DISTRICT

Ore Shipments—Shipments of ore for the week ending May 23 were as follows: Buffalo, 47,000 lb.; Coniagas, 62,640; La Rose, 140,000; McKinley-Darragh, 63,120; O'Brien, 275,450; Right of Way, 61,060; Silver Leaf, 63,820; Trethewey, 192,690; total, 905,780 pounds.

Foster-Cobalt—George H. Doran, managing director, has published a denial of the malicious rumors put in circulation to the effect that the property had been partially closed down and that operations would soon be completely suspended. He states that there are at present 36 men at work and in a short time a full complement of 50 men will be employed; the present reduction of the staff is on account of the change from winter development work to summer surface operations. The official record shows that since Jan. 1 the company has shipped 238,600 lb. of ore, not including 200,000 lb. sent to the concentrator, the results from which have not been ascertained.

ONTARIO—ALGOMA DISTRICT

Copper Mining and Smelting Company—Judge Johnson, of Sault Ste. Marie has appointed R. C. Jennings, Toronto, liquidator of this company at Bruce Mines, with instructions to dispose of the assets of the company, valued at about $350,000. An order to close up the affairs of the company was granted some time ago, but it was not put in force pending attempts to organize a new company. This attempt, however, proved unsuccessful.

Mexico

CHIHUAHUA

American Smelting and Refining—W. J. Mitchell, representing the company at Santa Eulalia, expects to deliver from 3000 to 4000 tons of ore monthly to the new smelting works at Chihuahua, and to ship about 4000 tons to El Paso. Work is going on at the new plant at Chihuahua, getting ready to blow in.

Dolores—The hydro-electric plant at Dolores is expected to be in operation by July 1. The company has built a dam 800 ft. long and 50 ft. high, which will impound 12,000,000 gal. of water to operate the plant and furnish 250 h.p. to run the mill by direct water power. The electric power, about 135 h.p., will be used to operate the hoists and mining machinery.

Rio Plata—The company produced from its Santa Barbara mine near Guazapares 108,000 oz. silver during the month of April, surpassing its previous monthly record by about 30,000 oz. The work of building a cyanide plant to treat the tailings is under way.

COAHUILA

Jimulco—It is reported that these mines will resume work after a shut-down of several months, owing to the financial trouble of the last six months.

GUANAJUATO

Production—The chief ore-buying agency, acting for the Aguascalientes smelting works, shipped during the week ending May 24, 130 tons of concentrates, valued at $48,500. The bullion shipments to Mexico for the same period amounted to $120,000.

Jesus Maria—Superintendent Smith stated in Mexico City recently that the reports of a bonanza strike at this mine have been exaggerated. Ore has been struck, but it is not very rich. Some of it carries silver and some gold.

JALISCO

Bautista—A decree has been advertised ordering these mines sold at auction at Guadalajara on May 28. The mines have been idle for months and are full of water. The decree is a result of a judgment secured by Rosalio Echeverria, who claims to have advanced money for the operation of the mine.

Buena Fe Mining Company—This new company has been organized in Texas by the Kirby Development Company with a capital stock of $300,000 to work an old property in the Ojuelos district. The holdings embrace 71 pertenencias.

Carrizo Copper Company—The smelting works of this company, although completed and ready to blow in, will not be put in operation until October after the rainy season.

MICHOACAN

Los Ocotes—The crosscut started several months ago from the bottom of the Rosario shaft of this mine in Tlalpujahua has cut a number of stringers of good ore, and the main vein is expected to be encountered any day.

QUERETARO

Ajuchitlan—The company is installing a complete electrical power equipment for the property near Bernal station on the National railroad. Power will be obtained from the Compañia Hidro-Electrica Queretana, of Queretaro, the transmission line being about 25 km. long. A 100-h.p. motor will drive the Kent mills and the crushers, and smaller motors will furnish power for pumps and other machinery.

SINALOA

El Palmarcito—This property, including mine and mill at Mocorito, has been closed down owing to the want of adequate machinery.

ZACATECAS

Compania Minera de la Luz—This company, owning gold and silver mines in the Panuco district, is shipping rich ore to the smelting works at Torreon. One carload yielded $2000. Pumps, hoists and other machinery is to be installed. The properties are owned chiefly by Torreon men.

Asia

JAPAN

A recent report, published in the *Japan Times*, gives the production of gold in Japan in 1907 at 88,653 oz., or $1,881,457. This compares with 95,747 oz. in 1906, showing a decrease of 7094 oz. The production of silver was 2,429,459 oz. in 1906, and 2,834,062 oz. in 1907; an increase of 404,603 oz. last year.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, June 3—In the West the coal trade is quiet almost everywhere. The Indiana miners and operators have at last come into line and have renewed the old agreement, with some slight modifications. There was a general resumption in the mines of that State on June 1. The demand for steam coal through the West improves slowly, and the Lake trade so far is only of moderate proportions.

In the East the trade, both anthracite and bituminous, is dull and without special features. The coastwise trade is also quiet for the season.

Reports have been in circulation in New York that the anthracite companies would soon increase the price of coal at tidewater; also that some of the large anthracite companies would establish distributing yards and enter the city retail business. A semi-official statement has been issued denying these reports positively.

Coal Traffic Notes

Tonnage originating on Pennsylvania railroad lines east of Pittsburg and Erie, year to May 23, in short tons:

	1907.	1908.	Changes.
Anthracite	2,227,785	2,177,732	D. 50,053
Bituminous	14,934,866	12,590,625	D. 2,344,241
Coke	5,602,513	2,688,395	D. 2,914,118
Total	22,765,164	17,456,752	D. 5,308,412

Total decrease this year to date was 23.3 per cent.

The Victor Fuel Company, of Colorado, reports for the 10 months of its fiscal year from July 1 to April 30 as follows:

	1907.	1908.	Changes.
Coal mined	1,448,265	1,408,002	D. 40,263
Coke made	84,883	60,025	D. 24,858

Most of the decrease was in the second half of the period covered.

The output of marketable anthracite recovered by coal washeries from culm banks is reported as follows for two years past:

	1906		1907	
	Tons.	Per Ct.	Tons.	Per Ct.
Shipped to market	3,846,501	93.7	4,301,082	89.9
Sold at mines	39,227	0.9	11,168	0.2
Used at collieries	220,580	5.4	472,612	9.9
Total	4,106,308	100.0	4,784,862	100.0

The increase in 1907 was 678,554 tons, or 16.5 per cent. The shipments in 1907 were 6.4 per cent. of the total anthracite shipments of the year.

Anthracite coal tonnage in May, though the figures have not yet been completed, was about the same as in April.

New York

Anthracite

June 3—The market is quiet and little business is being done. All sizes are in good supply. On June 1 the usual monthly advance of 10c. per ton took place on prepared sizes. Prices are as follows: Broken, $4.45; egg, stove and chestnut, $4.70; pea, $3.25@3.50; buckwheat No. 1, $2.35@2.50; buckwheat No. 2 or rice, $1.65@2; barley, $1.35@1.50; all f.o.b. New York harbor.

Bituminous

The soft-coal market seems to be practically at a standstill, not only in New York harbor but also throughout the consuming territories of the East. In New York harbor good grades of steam coal are offered at $2.45@2.55 per ton, with few takers.

In the Coastwise vessel trade only a small tonnage is being carried. Freight rates are as follows: From Philadelphia to Boston and Salem, 55@60c.; to Portland, 60c.; to Lynn and Portsmouth, 70c.; Newburyport, 75c.; Saco $1; Bath, 65@75c.; Gardiner, 80c.; Bangor, 70@75c.; to the Sound, 50@55c.; towages where usual.

Birmingham

June 1—Commercial coal operators in Alabama report a slight improvement in the coal market, but prices are still off. The iron-manufacturing companies are putting their mines back into commission one after another. Commercial coal operators have made no efforts to get business because of the low selling price of coal. The home consumption is improving as furnaces, mills and other industries resume operation. The production is still off between 30 and 40 per cent.

The coke production has been improved by the starting up of a number of ovens.

Chicago

June 2—Sales of coal are steady but not large. Summer quiet is settling on the trade, though there has been more business transacted in the last week than is customarily found at this season of the year. Eastern coals in general are dull, and Western show greater strength in the lower-priced than in the higher-priced coals. Contract making does not progress rapidly.

Lump and prepared sizes from Illinois and Indiana mines bring $1.65@2; run-of-mine $1.60@1.75; screenings $1.40@1.60 on the greater part of sales. Of Eastern coals smokeless is dull and in somewhat too great supply at $2.85@3.30 for run-of-mine, Youghiogheny is moving mostly on contract at $3.20 for ¾-in. gas, and Hocking is in light demand but ample supply at $3.15@3.30.

Anthracite sales have been backward, neither retailers nor consumers caring to take on supplies even under the discount.

Indianapolis

The mine operators and miners of this State have, at last, settled their differences. After considering each clause separately in joint conference both sides agreed to accept the report of the joint scale committee after certain changes in it had been made, and signed up a new contract. This means the end of the suspension and 16,000 idle men returned to work June 1.

Under the new agreement the operators agree to deliver powder to the working places. In the fining clause, the miners gain a point, making superintendents, managers and pit bosses liable to fines for failing to comply with the contract was agreed to, in compliance with the demands of the miners, as was also a clause exempting from fines against a stampede strike miners who are not present when a suspension occurs. These are about the only changes made from the contract of last year.

The mines will reopen at once, as a number of orders have been booked during the three weeks' suspension. The operators say they are satisfied with the contract and since the demand for coal has not been large, the suspension has not been detrimental. The miners are glad to return to work.

Pittsburg

June 2—The mines in the Pittsburg district are practically in full operation. There was another rise in the river; most of the river coal loaded in the pools and harbor has been sent to the lower ports and a number of empty coal boats and barges have been returned. The railroad mines are running on coal for shipments to the Northwest and there is no scarcity of cars and no scarcity of lake boats. The Pittsburg-Buffalo Company is increasing its production and has plans prepared for the building of a number of coke ovens at Marianna, the new town at the shafts recently sunk on its 10,000 acres of coal land in Washington county. No change in prices; mine-run coal is $1.15 and slack 75@82c. at mine.

Connellsville Coke—There is indication of a brisk revival. Several large contracts have been placed which total over 100,000 tons for deliveries through the last half of the year. The chief demand is for furnace coke, but there is also a call for foundry coke. Furnace coke for spot delivery is $1.65; on contract $1.85@2. Foundry coke is $2.10@2.25, both spot and on contract. The *Courier* gives production in both Connellsville fields at 169,888 tons. The shipments were 5943 cars as follows: To Pittsburg, 2254; to points west of Connellsville, 3274 cars; to points east, 415 cars.

Bessemer Coke Company—This company has bought a tract of 1037 acres of coal land, lying along Patterson Run, in Washington township, Greene county, and West Bethlehem township, in Washington county. It is within a short distance of the Mariana shaft of the Westmoreland Coal Company. Plans are being made to open a mine on the tract, and to build 500 coke ovens.

Foreign Coal Trade

Exports of coal from the United States, four months ended April 30, long tons:

	1907.	1908.	Changes.
Anthracite	687,539	703,018	I. 15,479
Bituminous	2,542,393	2,351,748	D. 190,645
Total coal	3,229,932	3,054,766	D. 175,166
Coke	285,985	258,192	D. 27,793

These exports do not include coal furnished to steamships in foreign trade. Canada took this year 2,129,381 tons of coal, or 69.7 per cent. of the total. The coke went chiefly to Mexico and Canada.

Imports of coal into the United States for the four months ended April 30, long tons:

	1907.	1908.	Changes.
Anthracite	2	15,023	I. 15,021
Bituminous	654,388	602,609	D. 51,779
Total coal	654,390	617,632	D. 36,758
Coke	54,342	41,444	D. 12,898

Canada furnished this year 386,726 tons of coal and nearly all the coke; Australia 189,491 tons coal. Imports are chiefly on the Pacific Coast.

Exports and imports of fuel in France, three months ended March 31, metric tons:

	Exports.	Imports.	Excess.
Coal	268,810	3,687,270	Imp.3,418,460
Coke	35,010	463,810	Imp. 428,800
Briquets	24,750	213,430	Imp. 188,680
Total	328,570	4,364,510	Imp.4,035,940
Total, 1907	360,130	4,484,560	Imp.4,124,430

Exports include fuel furnished to vessels in foreign trade, which amounted this year to 24,480 tons coal and 9500 tons briquets.

Welsh Coal Trade—Messrs. Hull, Blyth & Co., London and Cardiff, report current prices at Welsh ports as follows, under date of May 23: Best Welsh steam, $3.96; seconds, $3.78; thirds, $3.60; dry coals, $3.84; best Monmouthshire, $3.48; seconds, $3.36; best small steam, $2.40; seconds, $2.10; all per long ton, f.o.b. docks.

Iron Trade Review

New York, June 3—The recent activity in pig iron has moderated in some degree, and there is less buying, consumers being apparently, satisfied for the present. What iron is being sold is still at low prices, furnaces at work being disposed to meet the views of buyers. The sales have been chiefly of foundry iron, with some basic. There is practically no business in bessemer iron.

There has been a good deal of cutting in iron bars. The Eastern Bar Iron Association met recently and reaffirmed the base price of 1.50c. Pittsburg. There have been a number of sales, however, at 1.40c. tidewater, and lower, and the market is supplied at about that price.

To meet this bar-iron situation, the Carnegie company, on June 2, made a reduction of $4 per ton in steel bars, bringing the base price from 1.60c. down to 1.40c., Pittsburg. Chairman E. H. Gary, of the United States Steel Corporation issued this formal statement: "Some of the smaller manufacturers of steel bars who have not been in consultation with the larger manufacturers have been for some time selling steel bars at about $1.40 to meet the iron-bar competition, and some of the larger manufacturers have reached the decision that they will meet these conditions when and as required. This conforms to the views of the Steel Bar Committee. It will not affect prices generally, nor interfere with the movement in favor of the stability of business conditions."

Notwithstanding this statement, it is the general belief that other reductions will follow. The difference between pig iron and steel prices is abnormal, and the pressure for lower quotations is strong among all consumers.

A few fair orders are heard of occasionally. The Lackawanna Steel Company has taken a contract for 7000 tons of steel for the new ship-lock in the Black Rock canal. The Illinois Central has ordered 52,000 tons of basic open-hearth rails, to be made by the Tennessee company's works at Ensley. Rail orders otherwise continue light.

Birmingham

June 1—The pig-iron market in the Southern territory is showing some improvement and the sales made are equal to the production; some of the surplus is being moved off slowly. Small lots for immediate delivery have been selling at $12 per ton, No. 2 foundry, while larger lots, according to reports, can be had still at $11.50 per ton.

The Woodward Iron Company is opening a new brown-ore mine on its property and will push the work of repairs on its third furnace. The Republic company is said to be a little behind in deliveries and will endeavor to get its Thomas furnace in readiness.

Chicago

June 2—The iron market continues strong, and sales of pig iron have been heavy. In consequence of the rush to cover requirements of large and small consumers, prices have become firm at advances over last week's quotations at which several big orders were filled. No. 2 Southern is firm at $12, Birmingham ($16.35 Chicago) and No. 2 Northern at $17.50@18. Most of the business has been for iron to be delivered within the next three months. Selling agents are not anxious to contract for delivery in the last quarter of the year. Melters admit large requirements and to all appearances will continue to purchase as fast as they can advantageously do so. The tone of the market is once more one of confidence.

The average order is still small, but larger than it has been and orders are more numerous. On iron and steel products the market is not lively, except for structural materials. Railroad supplies are somewhat brisker. Coke is moving well, though not in correspondence to the increased sale of pig iron. The best Connellsville is still obtainable at $4.90 per ton.

Philadelphia

June 3—Within a few days the market has developed a stronger undertone than it has had for months. Quite a number of orders for immediate or early delivery have been placed yesterday and today, mostly foundry irons. Prices named are low, but it is already evident that our pig-iron people, while anxious to clear out stocks, are not over anxious to load up with business for even late summer delivery. The sudden change in tone is surprising and large consumers who are out of stocks and have new work coming in are nervous. Forge is not participating, as yet, in the improvement.

Steel Billets—No new business has been closed.

Bars—Reports today from several Valley mills indicate no change. Prices are low and weak, but conditions are liable to change suddenly.

Sheets—The only change is a request from a few large customers for an option at present prices to extend 60 days. It is hardly likely this will be granted, although the mills want business badly.

Pipes and Tubes—The locomotive works are struggling along and the numerous lesser shops are not getting much work.

Plates—The mills are creeping along. Prices are too low for further concessions. Small orders are coming along all the time.

Structural Material—Railroad requirements in a small way are beginning to loom up. Some city work was placed this week, but no large orders are in sight.

Scrap—The scrap market could not well be more lifeless.

Pittsburg

May 2—The feature of the steel market today is a cut of $4 a ton in the price of merchant-steel bars. An official announcement is expected to be made within a few days. A similar cut also was made in angles, channels and tees under 3 in., making the price 1.50c. instead of 1.70c. Steel bars have been sold at 1.60c. for over two years, but the cut was not a surprise as it has been known for several weeks that there has been considerable shading. While the Steel Corporation and other large interests have been adhering strictly to the old rate, one large concern and several smaller ones have been cutting the price; one interest, it is reported, quoted as low as 1.30c., or $6 a ton under the old "official" price. Steelmakers did not care to discuss the reduction in steel bars from 1.60c. to 1.40c., but all admitted that other finished steel products would be held firmly at the present prices. Makers of iron bars have been selling at 1.45c. and higher, Pittsburg, but since May 1, it is understood, this price has been generally cut to 1.40c. There is a strong indication that the steel-rail makers will meet the specifications of the railroads, which will be a concession, although the price will remain at $28.

The various mills in this district are running about 50 per cent. of capacity. The Jones & Laughlin Steel Company is running practically full. The contract for the big bridge to be built by the Pittsburg & Lake Erie Railroad Company at Beaver, Penn., has been awarded to the McClintic-Marshall Construction Company. The bridge will require about 14,000 tons of steel, which will be furnished by the Jones & Laughlin company. The Carnegie Steel Company also has received some good contracts for structural material.

Pig Iron—There has been a decline in demand for pig iron compared with the heavy contracts placed during the past two weeks, but the market is stronger. Standard bessemer is not in demand and remains at $16, Valley furnaces, but basic has advanced to $15.50, while some dealers are holding it at $15.75. An inquiry from the East for 5000 tons was lost to the Valley furnaces, as the lowest price named was $15.50 at furnace. It is understood the contract went to Virginia furnaces. No. 2 foundry iron is still in demand, and the minimum price quoted is $15 at furnace. Gray forge is not in particular demand, but the price remains firm at $14@14.25, Valley furnaces.

Steel—There is no demand for steel billets at the present price of $28, Pittsburg, with the freight divided, but there are a number of contracts being filled on a sliding scale based on the prevailing price of pig iron. Plates are still quoted at 1.70c., but are weak. Merchant-steel bars have been reduced $4 a ton from 1.60c. to 1.40c., Pittsburg.

Sheets—The sheet market remains practically unchanged. Black sheets are quoted at 2.50c.; galvanized, 3.55c. for No. 28 gage.

Ferro-Manganese—An advance of 50c. a ton is noted, sales having been made at $47@47.50, Pittsburg.

Foreign Iron Trade

The German Iron and Steel Union reports the pig-iron output in March at 1,046,998 metric tons, being 52,812 tons more than in February. The daily average were 34,282 tons in February and 33,777 tons in March. For the three months ended March 31, the total make was, in metric tons:

	1907.		1908.	
	Tons.	PerCt.	Tons.	PerCt.
Foundry iron	544,663	17.3	583,421	18.8
Forge iron	201,787	6.4	180,557	5.8
Steel pig	256,116	8.2	271,250	8.8
Bessemer pig	121,132	3.9	112,180	3.6
Thomas pig	2,015,902	64.2	1,955,105	63.0
Total	3,139,600	100.0	3,102,513	100.0

This shows increases of 38,758 tons in foundry iron and 15,134 in steel pig; decreases of 21,230 tons in forge iron, 8952 in bessemer and 60,797 in Thomas, or basic, pig. The total decrease this year was 37,087 tons, or 1.2 per cent.

Foreign Trade of Germany—Imports and exports of iron and steel and of machinery, in Germany for the three months ended March 31, metric tons:

	1907.	1908.	Changes.	
Imports:				
Iron and steel	145,905	139,462	D.	6,443
Machinery	14,860	16,929	I.	2,069
Total	160,765	156,391	D.	4,374
Exports:				
Iron and steel	814,094	868,207	I.	54,113
Machinery	75,659	82,889	I.	7,230
Total	889,753	951,096	I.	61,343

Imports of iron ore for the three months were 1,348,103 tons; exports, 921,985 tons. Imports of manganese ore were 91,735 tons; exports, 440 tons.

Bessemer Steel in Great Britain—The British Iron Trade Association reports the production of bessemer, or converter, steel for the full year as follows, in long tons:

	1906.		1907.	
	Tons.	Per Ct.	Tons.	Per Ct.
Acid	1,307,149	68.5	1,280,315	68.9
Basic	600,189	31.5	578,944	31.1
Total	1,907,338	100.0	1,859,259	100.0

There was decreases of 21,245 tons in basic, and of 26,834 tons in acid steel; the total loss being 48,079 tons, or 2.5 per cent. There were 67 converters in the United Kingdom in 1907, of which 44 were acid and 23 basic; 56 were in use last year. A partial list of finished forms, under which bessemer steel was sold, shows: Blooms and billets, 245,644 tons; rails, 832,576; bars, 321,138; merchant steel, 72,728 tons.

British Wrought Iron Production—The output of puddled iron in Great Britain is reported at 1,010,346 long tons in 1906, and 975,083 in 1907; a decrease of 35,263 tons. Of the finished wrought-iron products, bars were 45 per cent. of the total; sheets and plates, 12; strips and hoops, 12; rounds and squares 8 per cent. The balance was chiefly sold to finishing mills in the form of blooms. There were 1535 puddling furnaces in Great Britain, of which 1202 were operated last year.

Metal Market

Gold and Silver Exports and Imports
NEW YORK, June 3.
At all U. S. Ports in April and year.

Metal.	Exports.	Imports.	Excess.
Gold:			
Apr. 1908..	$14,476,341	$ 2,417,170	Exp. $12,059,171
" 1907..	2,219,844	4,974,527	Imp. 2,754,683
Year 1908..	18,335,344	19,846,243	" 1,510,899
" 1907..	7,923,148	16,621,142	" 8,697,994
Silver:			
Apr. 1908..	4,452,564	3,308,106	Exp. 1,144,458
" 1907..	4,862,998	3,970,443	" 892,455
Year 1908..	17,038,851	14,138,762	" 2,900,089
" 1907..	19,532,394	15,355,969	" 4,176,425

Exports from the port of New York, week ended May 30: Gold, $6,397,000, to France and Germany; silver, $481,705, chiefly to London. Imports: Gold, $227,737, from Central and South America; silver, $48,088, from the West Indies and Mexico.

Specie holdings of the leading banks of the world May 30, are reported, as below, in dollars:

	Gold.	Silver.	Total.
Ass'd New York	.....	.....	$298,729,800
England	$188,372,495	.....	188,372,495
France	606,592,195	$183,420,855	789,013,050
Germany	181,850,000	75,365,000	257,215,000
Spain	77,880,000	132,885,000	201,765,000
Netherlands	38,502,000	21,576,500	60,078,500
Belgium	20,856,665	10,428,335	31,285,000
Italy	181,615,000	21,975,000	203,590,000
Russia	557,000,000	37,930,000	594,930,000
Aust.-Hungary	233,790,000	66,675,000	300,465,000
Sweden	19,460,000	.....	19,460,000
Norway	7,465,000	.....	7,465,000
Switzerland	17,160,000	.....	17,160,000

The New York banks do not separate gold and silver. The foreign statements are from the *Commercial and Financial Chronicle* of New York.

The Treasury Department's estimate of the amount and kinds of money in the United States, June 1, is as follows:

	In Treasury.	In Circul'n.
Gold coin (inc. bullion in Treasury)	$ 171,662,303	$ 618,620,761
Gold certificates	42,022,380	783,708,489
Silver dollars	11,022,651	78,103,331
Silver certificates	17,385,516	456,668,484
Subsidiary silver	22,155,411	121,382,852
Treasury notes of 1890	16,101	5,053,899
U. S. notes	11,488,742	335,192,274
Nat. bank notes	60,997,318	637,452,199
Total	$336,750,422	$3,036,182,289

Population of the United States, June 1, 1908, estimated at 87,377,000; circulation per capita, $34.75. For redemption of outstanding certificates an exact equivalent in amount of the appropriate kinds of money is held in the treasury, and is not included in the account of money held as

assets of the Government. This statement of money held in the treasury as assets of the Government does not include deposits of public money in National Bank depositaries to the credit of the treasurer of the United States, amounting to $154,049,501. The total circulation shows a decrease of $50,111,812 from May 1; but an increase of $96,399,720 over June 1 of last year.

Gold and silver movement in France, three months ended March 31:

	Imports.	Exports.		Excess.
Gold.....	£149,990,000	£ 7,568,000	Imp.	£142,422,000
1907.....	30,103,000	66,231,000	Exp.	36,128,000
Silver....	31,913,000	42,727,000	Exp.	10,814,000
1907.....	38,448,000	32,172,000	Imp.	6,276,000

Imports of copper and nickel coins, 23,000 fr. in 1907, and 18,000 fr. in 1908; exports, 22,000 fr. in 1907, and 99,000 fr. this year.

The export gold movement has shown no increase this week, and a sharp fall in sterling exchange on June 2 indicates that it is at an end for the present. The total of over $40,000,000 which has gone out apparently satisfies immediate demands for repayment of money borrowed abroad in the stringent times of last winter. The shipments have gone chiefly to Paris on this movement, though it is understood that a considerable amount found its way to Germany. The movement had little effect on money conditions here, owing to the large surplus of the banks.

Silver Market

SILVER AND STERLING EXCHANGE.

		Silver.				Silver.	
May.	Sterling Exchange.	New York, Cents.	London, Pence.	June.	Sterling Exchange.	New York, Cents.	London, Pence.
28	4.8720	52⅞	24 3/16	1	4.8720	53	24 7/16
29	4.8720	53	24 7/16	2	4.8705	52⅝	24 1/16
30	.....	....	24 7/16	3	4.8705	52¾	24 5/16

New York quotations are for fine silver, per ounce Troy. London prices are for sterling silver, 0.925 fine.

The silver market has been quiet and fairly steady the past week, but closes slightly lower at 24 5/16d. in London. Without buying by the Indian government the market is not likely to show much improvement, unless outside demands arise which are not now in sight.

Messrs. Pixley & Abell report silver shipments from London to the East for the year to May 21:

	1907.	1908.	Changes.
India.....	£5,082,034	£3,083,318	D. £1,998,716
China.....	.....	516,400	I. 516,400
Straits.....	426,062	90,200	D. 335,862
Total.....	£5,508,096	£3,689,918	D. £1,818,178

Receipts for the week, £3000 from the West Indies, and £115,000 from New York; £118,000 in all. Exports, £194,000 to India.

Copper, Tin, Lead and Zinc

	Copper.			Tin.	Lead.	Spelter.	
May-June.	Lake, Cts. per lb.	Electrolytic, Cts. per lb.	London, £ per ton.	Cts. per lb.	Cts. per lb.	New York, Cts. per lb.	St. Louis, Cts. per lb.
28	12¾ @12⅞	12½ @12⅝	57⅛	28¼	4.32½ @4.37½	4.55 @4.60	4.40 @4.45
29	12¾ @12⅞	12½ @12⅝	57⅝	28¾	4.32½ @4.37½	4.55 @4.60	4.40 @4.45
30	.....	.....	.....	.....	.....	.....	.....
1	12¾ @12⅞	12½ @12¾	57⅝	28¼	4.32½ @4.37½	4.52½ @4.57½	4.37½ @4.42½
2	12¾ @12⅞	12½ @12¾	58⅛	28⅜	4.32½ @4 37½	4.50 @4.55	4.35 @4.40
3	12¾ @12⅞	12⅝ @12¾	57¾	28⅞	4.32½ @4.37½	4.50 @4.55	4.35 @4.40

London quotations are per long ton (2240 lb.) standard copper, which is now the equivalent of the former g.m.b's. The New York quotations for electroytic copper are for cakes, ingots or wirebars, and represent the bulk of the transactions made with consumers, basis, New York, cash. The price of cathodes is 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—The market is dull and featureless. Europe is buying very little, and while there has been some inquiry on the part of domestic consumers, few transactions have taken place. Manufacturers report a slightly better demand, but it is not yet sufficiently pronounced to encourage them to come into the market more largely. Quotations at the close are 12¾@12⅞c. for Lake copper; 12½@12¾c. for electrolytic in ingots, cakes and wirebars. The average of the week for casting copper is 12¼@12½ cents.

There has been considerable speculation in the London market for standard copper. It closed last week at £56 17s. 6d. for spot, £57 10s. for three months, and advanced on Friday to £57 12s. 6d. for spot, £58 5s. for three months. It continued firm on Monday and Tuesday of this week, and closes at £57 15s. for spot, £58 5s. for three months.

Statistics for the second half of May show an increase in the visible supplies of 3000 tons.

Refined and manufactured sorts we quote: English tough, £60@61; best selected, £60@61; strong sheets, £72@73.

The management of the Utah Copper Company has authorized the statement that the April production of copper of that company from its Bingham properties amounted to 3,323,000 lb., and that the cost of production was about 8½c. per lb. This was the largest single month's output in the history of the mine. The May record will show even more flattering results.

Copper exports from the United States in April were 33,042 long tons. The imports for the month were 5328 tons metal and 1650 tons in ore and matte; a total of 6978 tons. For the four months ended April 30 the total exports were 124,406 tons; imports, 27,219 tons; excess of exports, 97,187 tons. The exports this year shown an increase of 69,899 tons over last year.

Exports of copper from New York and Philadelphia for the week were 5437 long tons. Exports from Baltimore are reported by our special correspondent at 1863 long tons of copper.

Manufactured Copper—Sheets, cold-rolled, 18c.; hot-rolled, 17c. Wire, 14¾c. base.

Tin—The London tin market was subject to considerable manipulation, and at the close shows an advance of about £4 from the low point reached during the week, the quotations being cabled as £130 7s. 6d. for spot, £129 17s. 6d. for three months.

The domestic market is conspicuous through an entire absence of demand for future delivery tin and for larger lots of spot metal. The business which is being done is of a retail character only, and at the close spot tin can be bought at about 28⅞@29 cents.

Statistics for the month of May show an increase in the visible supplies of 2000 tons.

The production of tin in the Federated Malay States for the four months ended April 30 is reported at 15,253 long tons in 1907, and 16,657 in 1908; an increase of 1404 tons.

Tin stocks June 1 are reported as below, in long tons:

	In Store.	Afloat.	Total.
London.....	4,374	5,382	9,756
Holland.....	1,497	183	1,680
U. S., exc. Pacific ports	1,166	2,822	3,988
Total.....	7,037	8,387	15,424

The total shows an increase of 2183 tons over the May statement.

Lead—The demand for this metal continues good and considerable business has taken place. At the close we quote 4.32½ @4.37½c. New York.

The London market has also been more active, prices remaining unchanged at £12 15s. for Spanish lead, £12 17s. 6d. for English lead.

The unusually stormy weather which has prevailed in the Salt Lake valley during the past few weeks has materially interfered with new construction at the lead smelter of the United States Smelting, Refining and Mining Company, and it is now stated that it will be at least July 1 before the ore-purchasing department will begin to accept ore for treatment again.

Spelter—The consumption of this metal is improving somewhat, and several large orders came into the market this week. These were taken at slightly lower prices, and at the close we quote 4.50@4.55c. New York, 4.35@4.40c. St. Louis.

The London market is unchanged, good ordinaries closing at £19 15s., specials at £20 per ton.

Zinc Sheets—Base price is 7c. f.o.b. Lasalle-Peru, less 8 per cent.

Other Metals

Antimony—The market continues dull and prices remain stationary in spite of efforts from certain quarters to depress them. Abroad the price advanced £1 per ton last week. This did not affect the New York market. Prices are 8¾@9c. for Cookson's, 8½@8¾c. for Hallett's, and 8⅛@8⅜c. for ordinary brands.

Aluminum—Ingots, American No. 1, in large quantities, 33c. per lb. Rods and wire, 38c. base; sheets, 40c. base.

Cadmium—In 100-lb. lots, $1.25 per lb., Cleveland, Ohio.

Nickel—According to size of lot and terms of sale, 45@50c., New York.

Quicksilver—New York, $45 per flask. San Francisco, large lots nominal at $44.50, domestic, and $43, export; small orders, $45@46. London, £8 5s.

Platinum—Prices are $25 per oz. for hard platinum, $22.50 for ordinary, $17 for scrap.

German Metal Imports and Exports

Imports and exports of metals in Germany for the three months ended March 31 are reported as follows, in metric tons:

	Imports.	Exports.	Excess.
Copper	44,081	1,718	Imp. 42,363
Copper alloys, etc.	4,692	16,797	Exp. 12,105
Total copper	48,773	18,515	Imp. 30,258
Tin	3,863	766	Imp. 3,097
Tin alloys, etc.	54	597	Exp. 543
Total tin	3,917	1,363	Imp. 2,554
Lead	15,784	7,739	Imp. 8,045
Lead alloys, etc.	60	2,836	Exp. 2,776
Total lead	15,844	10,575	Imp. 5,269
Zinc	6,780	12,112	Exp. 5,332
Zinc manufac'res	475	6,500	Exp. 6,025
Total zinc	7,255	18,612	Exp. 11,357
Nickel	637	462	Imp. 175
Nickel oxide, etc.	14	62	Exp. 48
Total nickel	651	524	Imp. 127
Aluminum	613	267	Imp. 346

Imports and exports of ores and minerals, other than iron ore, for the three months were, in metric tons:

	Imports.	Exports.	Excess.
Gold ore	7	.....	Imp. 7
Silver ore	469	.....	Imp. 469
Copper ore	4,397	7,680	Exp. 3,283
Tin ore	2,307	21	Imp. 2,286
Lead ore	30,559	186	Imp. 30,373
Zinc ore	40,384	5,330	Imp. 35,054
Nickel ore	4,875	.....	Imp. 4,875
Tungsten ore	563	30	Imp. 533
Chrome ore	2,377	12	Imp. 2,365
Pyrites	143,357	3,924	Imp. 139,433

Imports of slag and slag products were 118,278 tons; exports, 16,373 tons.

Wisconsin Ore Market

Platteville, Wis., May 30—The highest price paid this week for zinc ore was $37, on a basis of $35@36 per ton of 60 per cent. zinc. The highest paid for lead ore was $55 per ton. An unusually large shipment of zinc ore was made this week, a part of the surplus stock moving which had been accumulating at outlying mines on account of the bad condition of the roads.

Ore shipments, week ended May 30, were:

Camps.	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Platteville	599,870	.....	.....
Benton	501,050	83,200	.....
Hazel Green	487,200	.....	.....
Linden	401,250	.....	46,020
Cuba City	279,400	80,000	.....
Mineral Point	245,650	.....	.....
Galena	239,400	.....	.....
Livingston	220,000	.....	.....
Days Siding	173,900	.....	.....
Elmo	147,070	.....	.....
Strawbridge	96,700	.....	.....
Harker	62,830	182,610	.....
Rewey	59,900	.....	.....
Highland	54,670	.....	.....
Total	3,568,890	345,810	46,020
Year to May 30	32,879,415	3,305,025	125,820

In addition to the above there was shipped to the electrostatic separator at Platteville, from Linden, 40,800 lb., and from Benton, 223,900 lb. of zinc concentrates.

Missouri Ore Market

Joplin, Mo., May 30—The highest price paid for zinc was $38, the assay base price ranging from $32 to $35 per ton of 60 per cent. zinc, and all grades averaging $32.76. Lead reached $60.50, an advance of $1.50; medium grades brought $57@59, all grades averaging $58.80 per ton. Lead prices were pushed up by the St. Louis Smelting and Refining Company coming into the market to clean up all reserve ore held for $60, and where the grade was particularly good $60.50 was paid.

The pulling of the pumps by the Vantage company in Center creek valley is greatly increasing the head of water in all the mines in the vicinity of the Underwriters Land Company's property. This is advancing the cost of ore production, but despite the declining zinc market the advancing lead market keeps up the spirits of producers to make the fight against the water encroachments.

Following are the shipments of zinc and lead ore from the district for the week ending May 30:

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	2,699,850	808,840	$68,407
Joplin	2,381,120	206,530	44,571
Galena	593,720	108,540	12,996
Duenweg	566,120	38,640	10,459
Oronogo	344,060	22,250	6,544
Alba-Neck	314,230	.....	5,494
Granby	312,350	25,330	5,245
Badger	224,810	38,500	4,814
Carthage	258,520	.....	4,524
Prosperity	211,150	5,730	3,647
Aurora	264,840	.....	3,367
Spurgeon	112,150	14,140	2,196
Quapaw-Baxter	116,300	5,760	1,914
Carl Junction	119,240	.....	1,908
Zincite	111,320	.....	1,781
Sarcoxie	78,070	.....	1,249
Miami	61,320	.....	674
Totals	8,769,180	1,274,260	$179,790
Five months	200,309,700	29,366,610	$4,200,838
Zinc value, the week, $144,294; 5 months,			$3,448,998
Lead value, the week, 35,496; 5 months,			751,840

Average ore prices in the Joplin market were, by months:

ZINC ORE AT JOPLIN.			LEAD ORE AT JOPLIN.		
Month.	1907.	1908.	Month.	1907.	1908.
January	45.84	35.56	January	83.58	46.88
February	47.11	34.92	February	84.58	49.72
March	48.66	34.19	March	82.75	49.90
April	48.24	34.08	April	79.76	52.47
May	45.98	33.39	May	79.56	56.05
June	44.82	.....	June	73.66	.....
July	45.79	.....	July	58.18	.....
August	43.22	.....	August	59.54	.....
September	40.11	.....	September	53.52	.....
October	39.83	.....	October	51.40	.....
November	35.19	.....	November	43.40	.....
December	30.87	.....	December	37.71	.....
Year	43.68	.....	Year	68.90	.....

Petroleum Exports

Exports of mineral oils from the United States, four months ended April 30, in gallons:

	1907.	1908.
Crude	30,607,658	33,027,114
Naptha	9,757,803	10,792,538
Illuminating	265,170,819	336,519,229
Lubricating	45,978,938	53,746,165
Residuum	21,463,651	13,677,904
Total	372,978,869	447,762,950

Paraffin is included in lubricating oils. Total increase this year, 74,784,081 gal., or 20.1 per cent.

Chemicals

New York, June 3—There is a feeling in the trade that business will soon become better. More inquiries have been received and there have been a few sales for future delivery. Prices remain unchanged and the volume of business is still small in nearly all branches.

Copper Sulphate—The market is dull and the consuming demand is small. A few parcels at reduced prices have been absorbed but the bulk of the salt is held at circular quotations. Quotations are $4.65 per 100 lb. for carloads and $4.90 for smaller quantities.

Nitrate of Soda—No change in the nitrate situation is reported. Business is quiet and prices remain firm at 2.32½c. for spot and 2.30 for other positions of 1908. Deliveries in 1909 fetch 2.30c. and for 1910 prices are nominally 2.32½c. Spot 96-per cent. grade sells for 2.37½c. It is reported that these quotations are shaded by dealers anxious to dispose of their holdings.

Nitrate of Soda—Messrs. Mortimer & Wisner, New York, report the position of nitrate in the United States on June 1 as follows, in long tons:

	1907.	1908.	Changes.
Stocks, Jan. 1	13,050	5,900	D. 7,150
Imports, 5 months	104,432	104,450	I. 18
Total Supplies	117,482	110,350	D. 7,132
Deliveries, 5 months	108,892	102,350	D. 6,542
Stocks, June 1	8,590	8,000	D. 590
Afloat for U. S.	125,000	50,000	D. 75,000

Quantities afloat include all cargoes due to arrive at United States ports up to Sept. 15 next.

Mining Stocks

New York, June 3—The stock markets, which were dull and rather heavy before the Saturday holiday, opened this week with sharp advances and active business. No special reason is assigned for the advance, and it had every appearance of a carefully prepared and adjusted movement. The advance has continued up to tonight without any serious check.

The curb market followed the Stock Exchange, and prices advanced. The copper stocks were especially active. Cobalt shares were also largely dealt in at advances. The Nevada stocks, however, are still neglected.

Boston

June 2—After the reaction, prices of mining shares have recovered somewhat, and a better feeling pervades the stock market. The annual report of the Amalgamated Copper Company and the declaration of a $1 dividend by North Butte helped matters along. These stocks have been selling right together. Amalgamated reached $68.12½, an advance of $5.87½ from the low, and North Butte $67.50, an advance of $5.75. Mohawk has had a good advance. Copper Range is up $4.50 from the low to $74.

North Butte Extension has been the curb feature, breaking to 37½c. tonight on free offering of the stock. It closed $1.62½ bid a week back. Nipissing has been a strong feature. The resignation of Capt. Palmer as general manager of the Davis-Daly Estates Company caused some surprise.

STOCK QUOTATIONS

NEW YORK	June 2
Name of Comp.	Clg.
Alaska Mine	⅛
Amalgamated	67
Anaconda	43
Balaklala	‡1
British Col. Cop.	4⅞
Butte & London	....
Butte Coalition	24⅛
Colonial Silver	¼
Cum. Ely Mining	8⅛
Davis Daly	3
Dominion Cop	1¾
Douglas Copper	4½
El Rayo	1¾
Florence	3¼
Foster Cobalt	.60
Furnace Creek	.15
Giroux	3⅛
Gold Hill	⅛
Goldfield Con.	5⅜
Granby	97
Greene Gold	⅛
Greene G. & S	1/16
Greenw'r & D.Val.	†.75
Guanajuato	2¼
Gnggen. Exp.	147
Hanapah	†.20
McKinley Dar.	¾
Micmac	3⅞
Mines Co. of Am.	1½
Mitchell Mining	⅜
Mont. Sho.C	⅞
Nev. Utah M. & S.	3⅜
Newhouse M. & S.	7
Nipissing Mines	7⅛
Old Hundred	⅞
Silver Queen	1⅛
Stewart	⅝
Tennessee Cop'r	36½
Tir-Bullion	1⅛
Union Copper	⅛
Utah Apex	4¼
Utah Copper	31½
Yukon Gold	4

*Ex. Div. †Ex. Rights.

BOSTON	June 2
Name of Comp.	Clg.
Adventure	2¼
Allouez	29
Am. Zinc	29¾
Arcadian	3⅞
Arizona Com	18¼
Atlantic	16¾
Bingham	.50
Boston Con	12¼
Calumet & Ariz.	110¾
Calumet & Hecla	675
Centennial	23
Con. Mercur	.41
Copper Range	73¼
Daly-West	10
Franklin	9
Greene-Can.	10
Isle Royal	20½
La Salle	14⅞
Mass	3¼
Michigan	9¾
Mohawk	58
Nevada	12
North Butte	66¾
Old Colony	.50
Old Dominion	35½
Osceola	93
Parrot	21¾
Quincy	87
Rhode Island	3
Santa Fe	1¾
Shannon	14
Superior	18
Tamarack	62
Trinity	14⅛
United Cop., com.	7¼
U. S. Oil	24¼
U. S. Smg. & Ref.	38
U.S.Sm. & Re., pd.	41⅞
Utah Con	42
Victoria	5¾
Winona	6¼
Wolverine	134
Wyandotte	1

‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	21¼
Am. Smelt. & Ref.	75¾
Am. Sm. & Ref., pf.	98
Bethlehem Steel	15
Colo. Fuel & Iron	28
Federal M. & S., pf.	74½
Inter. Salt	‡18½
National Lead	67¾
National Lead, pf.	‡99⅞
Pittsburg Coal	13⅜
Republic I. & S.	19⅛
Republic I. & S., pf.	70
Sloss-Sheffield	51¼
Standard Oil	601
U. S. Red. & Ref.	9¾
U. S. Steel	38¾
U. S. Steel, pf	102⅝
Va. Car. Chem	24¾

BOSTON CURB	
Ahmeek	‡73
Black Mt.	‡4¼
East Butte	6½
Hancock Con.	‡4¼
Keweenaw	6¾
Majestic	.69
Raven	1¼
Shawmut	‡.35
Superior & Pitts	11⅞
Troy Man	‡.45

ST. LOUIS	May 29	
N. of Com.	High.	Low.
Adams	.25	.15
Am. Nettie	.03	.02
Center Cr'k	2.00	1.50
Cent. C. & C.	69.00	67.00
C.C. & C. pd.	77.00	75.00
Cent. Oil	110.00	100.00
Columbia	5.00	3.00
Con. Coal	20.00	15.00
Doe Run	125.00	110.00
Gra. Bimet.	.20	.15
St. Joe	16.00	14.00

LONDON	June 3
Name of Com.	Clg.
Dolores	£1 5s 0d
Stratton'sInd.	0 1 6
Camp Bird	0 13 0
Esperanza	1 10 0
Tomboy	1 15 0
El Oro	1 4 6
Oroville	0 11 6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. June 3.

Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.32
Best & Belcher	.50
Caledonia	.10
Challar	.08
Comstock	.39
Con. Cal. & Va.	.35
Crown Point	.35
Exchequer	.22
Gould & Curry	.16
Hale & Norcross	.34
Mexican	.62
Ophir	2.82½
Overman	.06
Potosi	.07
Savage	.39
Sierra Nevada	.28
Union	.21
Utah	.05
Yellow Jacket	.70
TONOPAH STOCKS	
Belmont	.93½
Extension	.81½
Golden Anchor	.02
Jim Butler	.26
MacNamara	.32
Midway	.37
Montana	1.52
North Star	.07
Tono'h Mine of N.	8.50
West End Con	.43
GOLDFI'D STOCKS	
Adams	.03
Atlanta	.18½
Booth	.15
Columbia Mt	.13
Comb. Frac	.54
Cracker Jack	.05
Dia'dfield B. B. C.	.17
Goldfield Belmont	.13
Goldfield Daisy	.98
Great Bend	.28
Jumbo Extension	.25
Katherine	...
Kendall	.16
Lone Star	.06
May Queen	.05
Oro	.08½
Red Hill	.19
Roanoke	...
Sandstorm	.24

Name of Comp.	Clg.
Silver Pick	.14
St. Ives	.30
Triangle	.04
BULLFROG STOCKS	
Bullfrog Mining	.05
Bullfrog Nat. B.	.05
Gibraltar	.05
Gold Bar	.05
Homestake King.	.29
Montgomery Mt.	.06
Mont. Shoshone C.	.81½
Original Bullfrog.	.01½
Tramp Cons	.16
MANHAT'N STOCKS	
Manhattan Cons.	.09
Manhat'n Dexter.	.04
Jumping Jack	.04
Stray Dog	.04
MISCELLANEOUS	
Golden Boulder	.07
Bonnie Clare	.06
Lee Gold Grotto	...
Nevada Hills	2.06½
Nevada Smelting.	1.00
Pittsburgh S. Pk.	1.18
Round Mt. Sphinx	.26

COLO. SPRINGS	May 29
Name of Comp.	Clg.
Acacia	6
Black Bell	....
C. C. Con	3½
Dante	7¼
Doctor Jack Pot	‡7
Elkton	57
El Paso	36½
Findlay	22½
Gold Dollar	6
Gold Sovereign	3¼
Isabella	35¾
Index	....
Jennie Sample	3
Jerry Johnson	....
Mary McKinney	‡30
Pharmacist	3¼
Portland	1.00¾
Un. Gold Mines	4½
Vindicator	85
Work	10¼

Assessments

Company.	Delinq.	Sale.	Amt.
Andes, Nev.	Apr. 23	May 15	$0.10
Belcher, Nev.	Apr. 29	May 20	0.10
Big Creek, Ida.	Apr. 17	May 16	0.01
Brunswick Con., Cal.	May 27	June 26	0.03
Butler-Liberal, Utah.	Apr. 25	May 13	0.02
Century, Utah	Apr. 14	May 14	0.02
Charm, Utah	Apr. 31	May 13	0.01
Federal	Apr. 25	May 18	0.05
Jenny Lind, Cal.	May 11	May 28	0.05
New Red Wing, Utah.	May 2	May 19	0.01
New Stockton, Utah.	May 11	June 1	0.01
Old Evergreen	Apr. 14	May 14	0.02
Oro Cobre, Cal.	Apr. 17	May 16	0.02
Posey Canyon, Cal.	Apr. 28	May 16	0.10
Potosi, Nev.	Apr. 20	May 3	0.02½
Wabash, Utah.	May 9	June 1	0.10
Washakie-Nev., Nev.	Apr. 20	May 7	0.15
Western Mines, Nev.	Mar. 16	Apr. 23	0.01½
Zelbright, Cal.	May 12	June 1	0.05

Monthly Average Prices of Metals

AVERAGE PRICE OF SILVER

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	68.673	55.678	31.769	25.738
February	68.835	56.000	31.852	25.855
March	67.519	55.365	31.325	25.570
April	65.462	54.505	30.253	25.133
May	65.981	52.795	30.471	24.377
June	67.090	.....	30.893	.....
July	68.144	.....	31.366	.....
August	68.745	.....	31.637	.....
September	67.792	.....	31.313	.....
October	62.435	.....	28.863	.....
November	58.677	.....	27.154	.....
December	54.565	.....	25.362	.....
Year	65.327	.....	30.188	.....

New York, cents per fine ounce; London, pence per standard ounce.

AVERAGE PRICES OF COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1907.	1908.	1907.	1908.	1907.	1908.
January	24.404	13.726	24.825	13.901	106.739	62.386
February	24.869	12.905	25.236	13.098	107.356	58.786
March	25.065	12.704	25.560	12.875	106.594	58.761
April	24.224	12.743	25.260	12.928	98.625	58.331
May	24.048	12.598	25.072	12.788	102.375	57.387
June	22.665	.....	24.140	.....	97.272	.....
July	21.130	.....	21.923	.....	95.016	.....
August	18.356	.....	19.255	.....	79.679	.....
September	15.565	.....	16.047	.....	68.375	.....
October	13.169	.....	13.551	.....	60.717	.....
November	13.391	.....	13.870	.....	61.226	.....
December	13.163	.....	13.393	.....	60.113	.....
Year	20.004	.....	20.661	.....	87.007	.....

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

AVERAGE PRICE OF TIN AT NEW YORK

Month.	1907.	1908.	Month.	1907.	1908.
January	41.548	27.380	July	41.091	.....
February	42.102	28.978	August	37.667	.....
March	41.313	30.577	September	36.689	.....
April	40.938	31.702	October	32.620	.....
May	43.149	30.015	November	30.833	.....
June	42.120	.....	December	27.925	.....
			Av. year	38.166	.....

Prices are in cents per pound.

AVERAGE PRICE OF LEAD

Month.	New York.		London.	
	1907.	1908.	1907.	1908.
January	6.000	3.691	19.828	14.469
February	6.000	3.725	19.531	14.250
March	6.000	3.838	19.703	13.975
April	6.000	3.993	19.975	13.469
May	6.000	4.253	19.688	12.928
June	5.760	.....	20.188	.....
July	5.288	.....	20.350	.....
August	5.250	.....	19.063	.....
September	4.813	.....	19.775	.....
October	4.750	.....	18.531	.....
November	4.376	.....	17.281	.....
December	3.658	.....	14.500	.....
Year	5.325	.....	19.034	.....

New York, cents per pound. London, pounds sterling per long ton.

AVERAGE PRICE OF SPELTER

MONTH.	New York.		St. Louis.		London.	
	1907.	1908.	1907.	1908.	1907.	1908.
January	6.732	4.513	6.582	4.363	27.125	20.563
February	6.814	4.788	6.664	4.638	25.938	20.875
March	6.837	4.665	6.687	4.527	26.094	21.075
April	6.685	4.645	6.535	4.495	25.900	21.344
May	6.441	4.608	6.291	4.458	25.563	19.906
June	6.419	.....	6.269	.....	25.469	.....
July	6.072	.....	5.922	.....	23.850	.....
August	5.701	.....	5.551	.....	21.969	.....
September	5.236	.....	5.086	.....	21.050	.....
October	5.430	.....	5.280	.....	21.781	.....
November	4.925	.....	4.775	.....	21.438	.....
December	4.254	.....	4.104	.....	20.075	.....
Year	5.962	.....	5.812	.....	23.771	.....

New York and St. Louis, cents per pound. London in pounds sterling per long ton.

CHEMICALS, MINERALS, RARE EARTHS, ETC.—CURRENT WHOLESALE PRICES.

ABRASIVES—		
Bort, good drill quality, carat		$85.00
Carborundum, f.o.b. Niagara Falls, powd	lb.	.08
Grains	"	.10@.17
Corundum	"	.07@.10
Crushed Steel, f.o.b. Pittsburg	"	.05¾@.06
Emery, in kegs: Turkish flour	"	.01¾@.02½
Grains	"	.03¼@.04½
Naxos flour	"	.01½@.02½
Grains	"	.03½@.04½
Chester flour	"	.01½
Grains	"	.03½@.04½
Peekskill, f.o.b. Easton, Pa., flour	"	.01½@.01½
Grains, in kegs	"	.02½@.02½
Garnet, per quality	n ton	25.00@35.00
PumiceStone, Am. Powd. 100 lb.		1.60@2.00
Italian, powdered	"	.01¼@.01½
Lump, per quality	"	.03@.20
Rottenstone, ground	"	.02½@.04½
Lump, per quality	"	.05@.25
Rouge, per quality	"	.05@.30
Steel Emery, f.o.b. Pittsburg	"	.07¼@.07¾
ACIDS—		
Acetic 28%	lb.	.026@.03
Boric	"	.08@.08¼
Hydrofluoric, 30%	"	.02¾@.03
" 48%	"	.06
" 60%	"	.10
Hydrochloric acid, 20°, per lb		1.25@1.50
Nitric acid, 38°	per lb.	4.25@4.62½c.
Sulphuric acid, 50°, bulk, per ton		$12 up.
60°, 100 lb. in carboys		.85@1.12¼
60°, bulk, ton		16.00@18.00
66°, 100 lb. in carboys		1.00@1.25
66°, bulk, ton		18 00
Oxalic	"	.07@.07¼
ALCOHOL—Grain 95%	gal.	2.63
Denatured		.39@.45
Refined wood, 95@97%	"	.41@.47
ALUM—Lump	100 lb.	$1.75
Ground	"	1.85
Chrome Alum	lb.	.05½@.06
ALUMINUM—Sulphate, com'l	"	1.10@1.75
AMMONIA—24 deg. lb		.04½@.05¼
" 26 " "		.04¾@.05¾
AMMONIUM—		
Bromide	lb.	.23
Carbonate	"	.07½@.08
Muriate grain	"	.05¾@.06¼
Lump	"	.09½@.09½
Sulphate, 100 lb		3.05@3.10
Sulphocyanide com	"	.30
" " chem. pure	"	.40
ANTIMONY—needle, lump	lb.	.03¾@.04¼
ARSENIC—White		.03¾@.03¾
Red	"	.07½@.07¾
ASPHALTUM—		
Barbadoes	per ton.	40.00@80.00
West Indies	"	20.00@60.00
Egyptian	lb.	.12@.14
Gilsonite, Utah ordinary	per ton.	35.00
Trinidad	"	28.00@40.00
California	"	21.00@27.00
BARIUM—		
Carb. Lump, 80@90%	lg. ton.	30.00@35.00
Precipitated, 96@98%		31.50@33.00
Powdered, 80@90%	lb.	.02@.02½
Chloride com'l	ton.	38.00@40.00
Nitrate, powdered, in casks	lb.	.05½@.06
Blanc Fixe	per lb.	.02¼
BARYTES—		
Am. Ground	sh. ton.	14.00@21.00
Floated	"	22.00
Foreign floated	"	19.50@22.50
BISMUTH—Sub-nitrate	lb.	1.50
BLEACHING POWDER—35%, 100	lb.	1.25@1.40
BLUE VITRIOL—(copper sulphate), carload, per 100 lb		4.65
BONE ASH	lb.	.02½@.04
BORAX	"	.04½@.05¼
CALCIUM—Acetate, gray	"	2.00@2.05
Acetate, brown	"	1.25@1.30
Carbide, ton lots f.o.b. Niagara Falls, N. Y., for Jersey City, N. J.	sh. ton.	65.00
Chloride, f.o.b. N. Y	"	12.50@15.00
CEMENT—		
Portland, Am. 500 lb	bbl.	1.55@1.60
Foreign	"	2.25@2.90
"Rosendale," 300 lb	"	.85
(in sacks)	"	.65
Slag cement	"	.75@1.25
CHROME ORE—		
New Caledonia 50% ex. ship N. Y.	per lg. ton	17.50@20.00
Bricks, f.o.b. Pittsburg, M	"	175.00
CLAY, CHINA—Am. common ex-dock, N. Y	"	8.50@9.00
Foreign	"	10.00@17.50
COBALT—Oxide	lb.	1.45
COPPERAS—Bulk	100 lb.	$0.55
In bbls	"	.65@.75
In bags	"	.60@.70
CRYOLITE	lb.	.06½@.06¾
FELDSPAR—Ground best	sh. ton.	10.50@15.00
FIRE BRICK—		
American	per M.	30.00@40.00
Imported	"	30.00@45.00
St. Louis No. 1	"	18.00
" No. 2	"	15.00
Extra	"	20.00@23.00
FIRE CLAY—F. o. b. St. Louis.		
St. Louis, extra quality	per ton	5.00
" ordinary	"	2.50
FLUORSPAR—		
Domestic f.o.b. shipping port:		
Lump	lg. ton.	8.00@10.00
Ground	"	11.50@13.50
Foreign crude ex. dock		8.00@10.00
FULLER'S EARTH—Lump, 100 lb.		.75@.85
Powdered	"	.75@.85
GRAPHITE—Ceylon		
Flying dust, finest to best	lb.	.01@.04
Dust	"	.01¾@.05
Chip	"	.02¾@.07½
Lump	"	.04@.10
Large lump	"	.07@.10
GYPSUM—		
Fertilizer	sh. ton.	5.00
Ground	sh. ton.	4.00@7.00
INFUSORIAL EARTH—		
Ground Am. best	lb.	.01¾
French	lg. ton.	56.00
German	lb.	.02½@.02¾
LEAD—Acetate (sugar of) brown	lb.	.07¾
Nitrate, com'l	"	.08¼@.09¼
MAGNESITE—Greece.		
Crude (95%)	lg. ton.	8.00@10.00
Calcined, powdered	sh. ton.	30.00@40.00
Bricks, domes, per qual. f.o.b. Pittsburg	M.	160@200
MAGNESIUM—		
Chloride, com'l	100 lb.	.80@1.00
Sulphate (Epsom salt)	100 lb.	.85@1.00
MANGANESE—		
Foreign, crude, powdered:		
70@75% binoxide	lb.	.01@.01¼
75@85% binoxide	"	.01¼@.01½
85@90% binoxide	"	.01½@.05
90@95% binoxide	"	.06½
Ore, 80%-85%	sh. ton.	18.00@40.00
MARBLE—Flour	sh. ton.	8.50@10.00
MINERAL WOOL—		
Slag, ordinary	"	19.00
Selected	"	25.00
Rock, ordinary	"	32.00
Selected	"	40.00
MONAZITE SAND—		
Guar. 97%, with 5% Thorium oxide, nominal	lb.	.08 and up.
NICKEL—		
Oxide, crude, lb. (77%) for fine metal contained		.47
Sulphate, single	lb.	.09@.11
" double	"	.06½@.08
NITRATE OF SODA—100 lb. 95% for '07		2.45
95% for 1908		2.45@2.50
95% for 1909		2.40
96% is 5c higher per 100 lb.		
OZOKERITE—best	lb.	.14@.17
PAINTS AND COLORS—		
Litharge, Am. powdered	"	.06½@.06¾
English glassmakers'	"	.08¼@.08½
Lithopone	"	.03½@.07
Metallic, brown	sh. ton.	16.50@22.00
Red	"	14.00@18.00
Ocher, Am. common	"	8.50@9.00
Best	"	16.00
Dutch, washed	lb.	.02½@.03
French, washed	"	.01½@.02½
Paris green, pure, bulk	"	.26
Red lead, American	"	.06½@.06¾
Foreign	"	.08¼@.08¼
Turpentine, spirits bbl., per gal.		.58
White lead, Am., dry	lb.	.05¾@.06
American, in oil	"	.06¼@.06½
Foreign, in oil	"	.10¼@.10½
Zinc white, Am. extra dry	"	.05½@.05¾
French, red seal, dry	"	.08½@.08¾
" Green seal, dry	"	.10½@.10½
PHOSPHATES—Acid	65@70% per unit	
*Fla., hard rock		10.25@10.50
land pebble 68%		4.00@4.25
†Tenn., 78@80%		7.00@7.50
75%		4.50@5.00
68@72%		4.00@4.25
‡So. Car. land rock		6.75@7.00
" " river rock		7.00@7.25
POTASSIUM—		
Bicarbonate crystal	lb.	$.08½@.09
Powdered or granulated	"	.09@.09½
Bichromate, Am	"	.08½@.09
Scotch	"	.10½
Bromide	"	.15@.17
Carbonate (80@85%)	"	.03½@.04
Caustic, ordinary	"	.04½@.05½
Elect. (90%)	"	.05½@.06
Chloride (muriate), 100 lb		1 90
Chlorate, powdered	"	.09½@.09½
Crystals	"	09@09½
Cyanide (98@99%)		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Kainite, long ton, bulk, 8.50; bags, 9.50.		
Permanganate	lb.	.09½@.10
Prussiate, yellow	"	.14½@.15
Red	"	.33@.38
Sulphate	100 lb.	2.18½@2.21½
PYRITE—		
Domestic, non-arsenical, furnace size, f.o.b. mines	per unit	11@11½c.
Domestic, non-arsenical, fines, per unit, f.o.b. mines		10@10½c.
Imported non-arsenical, furnace size, per unit		.12½@.13
Imported, arsenical, furnace size, per unit		.12@.12½
Imported fines, arsenical, per unit		.08½@.09
" " non-arsenical, per unit		10½@11c.

Pyrite prices are per unit of sulphur. An allowance of 25c. per ton is made when delivered in lump form.

SALT—N. Y. com. fine 280 lb.	bbl.	.72@1.13
N. Y. agricultural	sh. ton.	3.80@4.50
SALTPETER—Crude	100 lb.	4.50@5.00
Refined, crystals	"	5.50@6.00
SILICA—		
Ground quartz, ord'ry	lg. ton	10.00@15.00
Silex	"	13.00@40.00
Lump Quartz	"	5.00@6.00
Glass sand	"	2.75
SILVER—Nitrate, crystals	oz.	.36@.39
SODIUM—		
Acetate	lb.	.04¼@.04¾
"Alkali," per 100 lb., 58/48		.80@.87½
Bicarb. soda, per 100 lb		1.10@1.40c.
Soda, caustic, per 100 lb., 76/60		1.75@1.85
" " powdered		.02¾@.03½
Salt cake, per 100 lb, bulk		.40
" " bbl		.65@.85
Soda, monohydrate, per lb		1.4@1.75c.
Bichromate	lb.	.07½@.07¾
Bromide	"	.16@.17
Chlorate, com'l	"	.09@.09½
Cyanide ("100% KCN")		
Carloads (30,000 lb.)	"	18c.
5-ton lots	"	18½c.
Less than 5 tons	"	19c.
Hyposulphite, Am	"	1.35 up
German	"	1.60@1.70
Phosphate	100 lb.	2.10@2.30
Prussiate	"	.09@.09½
Sal soda, f.o.b. N. Y	100 lb.	.65@.70
Foreign, f.o.b. N. Y	"	.80@1.00
Silicate, com'l	100 lb.	.80@1.15
Sulphate, com'l, (Glauber's salt)	100 lb.	.60@.75
" " calcined		.65@.85
STRONTIUM—Nitrate	lb.	.08@.08½
SULPHUR—		
Louisiana (prime) to New York, Boston or Portland	lg. ton	22.00
To Philadelphia or Baltimore	"	22.00
Roll	100 lb.	1.85@2.15
Flour	" "	2.00@2.40
Flowers, sublimed	" "	2.20@2.60
TERRA ALBA—French & Eng.	100 lb.	.65@1.00
TALC—Domestic	sh. ton.	15.00@25.00
French	"	16.00@25.00
Italian, best	"	35.00@40.00
TIN—Bi-chloride, 50%	lb.	.08¾
Crystals	"	.18¾ up
Oxide, lb		.33@.35
URANIUM—Oxide	"	3.50
ZINC—		
Chloride solution, com'l 20°	"	.02½
Chloride, granular	"	.04½@.05
Dust	"	.05½@.06
Sulphate	"	2.15 up

*F. o. b. Florida or Georgia ports. †F. o. b. Mt. Pleasant. ‡On vessel Ashley River, S. C.

NOTE—These quotations are for ordinary wholesale lots in New York unless otherwise specified, and are generally subject to the usual trade discounts. In the cases of some of the important minerals, such as phosphate rock, pyrites, and sulphur, in which there are well established markets, the quotations fully represent the latter. But in the cases of some of the minor mineral products, the quotations represent what dealers ask of consumers and not what producers can realize in selling their outputs as matters of private contract.

THE MINING INDEX.

The editors of this paper read all the important publications of the world that relate to mining and the treatment of minerals. This index is published as a reference for all interested and to make it impossible for readers of the ENGINEERING AND MINING JOURNAL to miss any important article published anywhere.

We will undertake to furnish a copy of any article (if in print) in the original language, for the price quoted. Where no price is quoted the cost is unknown. These papers are not kept in stock, but must be ordered from the publisher; hence there will be some delay for foreign papers.

No accounts can be opened for these small amounts, but remittance must be sent with order. For the convenience of those making small but frequent remittances, coupons are furnished at the following prices: 20 cents each, six for $1.00, thirty-three for $5.00 and one hundred for $15.00. This arrangement will be especially appreciated by foreign readers and men in distant mining camps. Where remittances are made in even dollars we will return the excess over an order in coupons upon request.

ANTIMONY

6318—ARKANSAS ANTIMONY DEPOSITS. Frank L. Hess. (U. S. Geol. Surv. Bull. No. 340-D, 1908; 12 pp.) The economic and geologic features of the comparatively little known and recently neglected Arkansas deposits of antimony, all of which lie in the northern part of Sevier county.

ASPHALTUM

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6414—YUKON TERRITORY—Yukon Gold and Some Other Mines. (Eng. and Min. Journ., May 16, 1908; 1 p.) Interesting notes from the report of H. H. Rowatt, who was commissioned by the Canadian Minister of the Interior to investigate conditions in the Yukon last summer. 20c.

GRAPHITE

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IRON AND STEEL

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6420—BRITISH OPEN-HEARTH STEEL INDUSTRY in 1907. (Iron and Coal Tr. Rev., Apr. 17, 1908; 1 p.) A review of the British steel industry during 1907, containing statistics of production of the different grades of steel for a period of years. 40c.

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6422—CANADA—The Iron Ores of Canada. C. K. Leith. (Quart. Bull. Can. Min. Inst., May, 1908; 15 pp.) Calls attention to certain general features of comparison of Canadian iron ores with the several types of deposits of the United States.

6423—COATING IRON WITH ZINC—Protection of Iron and Steel Surfaces by Means of Zinc. (Electrochem. and Met. Ind., May, 1908; 5 pp.) An interesting résumé of the methods of protecting iron and steel surfaces by means of zinc; illustrated. 40c.

6424—CUBAN ORE DEPOSITS. (Iron and Coal Tr. Rev., May 1, 1908; ¾ p.) This editorial discusses the importance of the Cuban iron ore deposits and their effects upon the American iron trade. 40c.

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6428—ELECTRIC SMELTING—The Reduction of Iron Ores in the Electric Furnace. R. Turnbull. (Quart. Bull. Can. Min. Inst., May, 1908; 7 pp.) Outlines the progress made in connection with the reduction of iron ores in the electric furnace since the close of the Government experiment at Sault Ste. Marie in March, 1906.

6429—ELECTRIC STEEL. Frank C. Perkins. (West. Electrician, Apr. 25, 1908; 1 p.) Mentions the wonderful development in the last decade in the use of the electric furnace and describes the Heroult new electric furnace for the complete reduction of iron from the ore and converting the same into steel. 20c.

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6432—FOUNDRY PRACTICE — Modern Jobbing Steel Foundry Practice. (Iron Tr. Rev., Apr. 23, 1908; 6 pp.) Describes the circular flask equipment, the stacking of molds for small duplicate work, and other methods in use in the new plant of the Bucyrus Steel Casting Company, of Bucyrus, O. 20c.

6433—HUNGARY—The Iron Industry in Hungary. P. Martell. (Iron and Coal Tr. Rev., May, 8, 1908; ¾ p.) Contains many interesting facts regarding industrial conditions in the Hungarian iron trade. Translated from *Giesserei Zeitung*. 40c.

6434—JAPAN—Japan's Manufacture and Importation of Iron Goods. M. Kawara. (Eng. Mag., May, 1908; 8 pp.) Discusses the past and present of the iron industry in Japan in its different phases, and gives the imports of iron manufactures from 1882 to 1907. 40c.

6435—MAGNETITE BELTS of Putnam County, N. Y. C. A. Stewart. (Sch. Mines. Quart., Apr., 1908; 12 pp.) Discusses the magnetite lenses in the gneisses of the highlands of New York and New Jersey, and describes some of the mines of the district. 60c.

6436—MALLEABLE CASTINGS — Production of Malleable Castings—IV. Richard Moldenke. (Foundry, May, 1908; 4 pp.) Continuation of article previously mentioned in this Index, dealing in the present instalment with malleable mixtures and the materials required, including pig iron and various classes of scrap. 20c.

6437—MALLEABLE CASTINGS by a New Process. (Iron Age, Apr. 23, 1908; 1½ pp.) Describes the process of producing malleable castings by melting wrought scrap in the crucible and in the open hearth furnace. 20c.

6438—MALLEABLE IRON CASTINGS. C. H. Gale. (Iron Age, Apr. 23, 1908; 1½ pp.) Compares the furnaces used and methods of annealing, and mentions the physical characteristics of malleable iron. Paper read before the Pittsburg Foundrymen's Assn., Apr. 6, 1908. 20c.

6439—NEW BRUNSWICK—A New Iron Ore Field in the Province of New Brunswick. John E. Hardman. (Quart. Bull. Can. Min. Inst., May, 1908; 9 pp.) A preliminary description of a large newly discovered deposit of iron ore near the shore of the Bay of Chaleur, in the province of New Brunswick.

6440—NEW YORK—Geology of the Adirondack Magnetic Iron Ores with a Report of the Mineville-Port Henry Mine Group. David G. Newland and James F. Kemp. (Univ. of State of N. Y., Education Dept. Bull. No. 423, Apr., 1908; 182 pp.) A thorough and comprehensive sketch of the geography, topography, and geology of the region, with a description of some of the mines.

6440a—NEW YORK—The Forest of Dean Iron Mine, New York. Guy C. Stoltz. (Eng. and Min. Journ., May 30, 1908; 2⅓ pp.) Description of a magnetite mine within fifty miles of New York City, which was worked before the Revolutionary War and is still yielding commercial ore; illustrated. 20c.

6441 — NODULIZING — Pulverized Fuel Combustion in Nodulizing Iron Ores. (Iron Tr. Rev., Apr. 23, 1908; 1¾ pp.) Describes a method for concentrating the lower grades of iron ore of the Lake Superior region, which were originally passed over in favor of the richer ore. The low-grade ores are nodulized by subjecting them to high temperatures in rotary kilns. 20c.

6442—NORWAY — South Varanger Iron Ore Deposits. (Iron and Coal Tr. Rev., May 8, 1908; ¾ p.) Contains some interesting supplementary information regarding these immense deposits. 40c.

6443—ONTARIO—The Iron and Steel Industry of the Province of Ontario, Canada. (Quart. Bull. Can. Min. Inst., May, 1908; 27 pp.) Touches on the general progress in the manufacture of iron and steel and gives a brief outline of the more important plants in the province.

6444—STEEL PLANT—Ensley Plant, Tennessee Coal, Iron and Railroad Company. Albert Phenis. (Mfrs. Rec., May 21, 1908; 2¾ pp.) After a short discussion of the iron and steel industry of Alabama, the Ensley plant is described; illustrated. 20c.

6445—STEEL PLANT—The New Iron Works of the Staveley Company. (Engineering, Apr. 10, 17, May 1, 1908; 9 pp. Continuation of article previously indexed. Describes and discusses the general arrangement of the stoves, temperature equalizers and dust catchers, and the gas-fired boilers and blowing engines at the works of the above company; also the coal-crushing and coke oven plant and the methods of cleaning the waste gases. $1.20.

6446—STEEL PLANT—The New Iron Works of the Staveley Company. (Engineering, May 15, 1908; 3 pp.) The concluding number of this article, describing the pumping plant and the electric power installation. 40c.

6447—STEEL RAILS—Specifications for Bessemer and Open-Hearth Rails. (Iron Tr. Rev., Apr. 30, 1908; 2¾ pp.) Gives the specifications adopted by the American Railway Association, in which much stress is placed upon tests, and the great care to be taken in keeping records showing effect of usage. 20c.

6448—SWEDEN—Zur Geschichte des schwedischen Hüttenwesens. P. Martell. (Oest. Zeit. f. B. u. H., Mar. 28, 1908; 7½ pp.) Reviews the present condition of the iron industry at the several metallurgical plants in Sweden. 40c.

LEAD

6449 — HEBERLEIN PROCESS — Zum chemischen Studium des Heberlein-Bleiprozesses. R. Tandler. (Chem. Zeit., Apr. 29, 1908; ½ p.) A further discussion of the reactions that probably occur in the pot-roasting process. 40c.

6450 — HUNTINGTON - HERBERLEIN PROCESS—Ueber das Huntington-Heberlein-Verfahren. P. Weiller. (Chem. Zeit., Apr. 1, 1908; ½ p.) Discussion of the reactions that occur in this method of roasting lead sulphide. 20c.

6451—PRODUCTION of Lead in the United States in 1907. Editorial. (Eng. and Min. Journ., May 9, 1908; 1 p.) Gives the production of refined lead in the United States in 1907, together with the corresponding figures for 1906, which are based on reports received directly from the smelters and refiners. 20c.

6452 — VOLUMETRIC DETERMINATION of Lead by the Use of Potassium Chromate. W. H. Seamon. (West Chem. and Met., Apr., 1908; 6½ pp.) Gives a complete scheme for the determination of lead by the use of potassium chromate, which has been successfully applied to different classes of ores. 60c.

6453—WHITE LEAD—The Story of the Manufacture of White Lead Paint. T. A. Rickard. (Min. and Sci. Press, May 9, 1908; 15 pp.) Goes fully into lead mining, as carried on at the Bunker Hill and Sullivan mine, milling and smelting operations, and the conversion of metallic lead to white lead. 20c.

MANGANESE

6454 — AUSTRIA-HUNGARY — Manganerz-Bergbau in der Bukowina, Theodor Naske. (Stahl u. Eisen, Apr. 15, 1908; 4½ pp.) Describes the geology of the deposit and gives details of the methods of mining and concentrating the ore. 40c.

MOLYBDENUM

6455 — MOLYBDENUM — Some Molybdenum Deposits of Maine, Utah, and California. Frank L. Hess. (U. S. Geol. Surv. Bull. No. 340-D; 1908; 10 pp.) Goes into the geology, methods of mining and milling and describes some of the operations in the States mentioned.

NICKEL AND COBALT

6456—COBALT—Die seltenen Metalle, Kobalt, Vanadium, Molybdän, Titan, Uran, Wolfram und ihre Bedeutung für die Technik unter besonderer Derücksichtigung der Stahlindustrie. A. Haenig. (Oest. Zeit. f. B. u. H., Apr. 11, 1908; 4 pp.) First instalment, enumerating the sources of ore supplies, and stating the physical effect of cobalt upon steel. 40c.

6457—COBALT—Metallurgical Conditions at Cobalt, Ontario, Canada, 1908. F. N. Flynn. (Quart. Bull. Can. Min. Inst., May, 1908; 42 pp.) A general description of conditions, bringing up some important problems in metallurgy.

6458—COBALT SULPHIDES—Ueber das schmelzdiagramm der Kobalt—Schwefellegierungen. K. Friedrich. (Metallurgie, Apr. 8, 1908; 7 pp.) A study of the characteristics of cobalt-sulphur compounds, illustrated with micrographs. 40c.

6459 — DETERMINATION — Dycyandiamide in the Determination and Separation of Nickel. H. Grossmann and B. Schück. (Eng. and Min. Journ., May 23, 1908; ½ p.) Gives a new method which is said to be both rapid and accurate. 20c.

PETROLEUM

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6462—REFINING—Review of Statistical and Technical Facts Submitted to the President of the United States by the Commissioner of Corporations. L. H. Eddy. (Cal. Derrick, Apr., 1908; 4 pp.) Continuation of article previously mentioned in the Index, the present instalment dealing with refining operations and the prices and values of lubricating oil. 20c.

6463—RUMANIA—A New Rumanian Law for Dividing the Home Consumption Between the Various Refineries. (Petrol. Rev., Apr. 25, 1908; 1¾ pp.) Gives the full text of the new Rumanian law for the regulation of the production of illuminating oil, the division of the home consumption of illuminating oils among the various refineries and the selling price for the home trade. 40c.

6464—RUMANIA—Le Pétrole de Roumanie et le Congrès de Bucarest. A. Aron. (Ann. des Mines, T. XIII, 1908; 84 pp.) Discusses the whole Rumanian petroleum industry, including geology, modes of operation, transportation, marking, etc.

6465—RUMANIAN PETROLEUM INDUSTRY During 1907. (Petrol. Rev., Feb. 29, 1908; 2¼ pp.) This article, translated from *Monit du Petrole Roumain*, states the monthly product of Roumania in 1906 and 1907; gives the output of leading camps, the amount of drifting done during the year and also the consumption of petroleum in Rumania. 40c.

PHOSPHATE ROCK

6466—PHOSPHATE DEPOSITS in the Western United States. F. B. Weeks. (Am. Fertilizer, Apr., 1908; 3½ pp.) A general review of field developments in 1907 in Utah, Wyoming and Idaho, and conditions affecting the industry. 20c.

POTASH SALTS

6467 — POTASH SALTS — Deutschlands Kalibergbau. (Oest. Zeit. f. B. u. H., Feb. 29, 1908; 4 pp.) Review of a work on the geology, the chemistry, the mining and the other industries connected with the potash salt deposits of Germany. 40c.

RARE METALS

6468—COLORADO—Carnotite and Associated Minerals in Western Routt County, Colo. Hoyt S. Gale. (U. S. Geol. Surv. Bull. No. 340-D; 1908; 6 pp.) Goes into the structure, stratigraphy and nature of the deposits.

6469—MONAZITE DEPOSITS of the Carolinas. Douglas B. Sterrett. (U. S. Geol. Surv. Bull. No. 340-D; 1908; 14 pp.) Goes into the geography, physiography, geology and occurrence of monazite in the Carolinas.

6470—ORE TREATMENT—Memoir on the Methods of Treatment of Simple and Complex Ores of Molybdenum, Tungsten, Uranium, Vanadium. Gustave Gin. (Trans. Am. Electrochem. Soc., Vol. XII, 1907; 64 pp.) A full and comprehensive discussion of molybdenum ores, their concentration and purification, treatment of the concentrate for the the extraction of its different products, and discusses the refining of the metal.

6471 — REDUCTION BY SILICON — Silicium als Reduktionsmittel für die Oxyde Schwer Schmelzbarer Metalle. B. Neumann. (Zeit. f. Elektrochem., Apr. 3, 1908; 3 pp.) Describes experiments on the reduction by means of metallic silicon of the oxides of chromium, tungsten, titanium, and molybdenum. 40c.

6472—STEEL HARDENING METALS—Die seltenen Metalle, Kobalt, Vanadium, Molbdän, Titan, Uran, Wolfram und ihre Bedeutung für die Technik unter besonderer Berücksichtigung der Stahlindustrie. A. Haenig. (Oest. Zeit. f.B.u.H., Apr. 11, 18, 25 and May 2, 1908; 13 pp.) Enumerates the ore supplies of cobalt, vanadium, molybdenum, titanium, uranium, and tungsten, and states the physical effect of each metal upon steel. $1.60.

6473—TEXAS—Minerals of the Rare-Earth Metals at Baringer Hill, Llano County, Tex. Frank L. Hess. (U. S. Geol. Surv. Bull. No. 340-D; 1908; 9 pp.) Describes the deposits and discusses the geology of Baringer Hill, situated about 100 miles northwest of Austin.

6474—VANADIUM—The Determination of Vanadium. Arden M. Wilson. (Eng. and Min. Journ., May 9, 1908; ¾ p.) Describes the ore treated at the mill of the Vanadium Alloys Company, at Newmire, Colo., and the method in use for the determination of vanadium. 20c.

SULPHUR

6475—SICILIAN SULPHUR—Impiego del Minerale di Solfo. (Rassegna Mineraria, Feb. 21, 1908; 4¾ pp.) The sources of sulphur for use in the manufacture of sulphuric acid are discussed, and the special advantages of Sicilian sulphur ores for that purpose are stated. 40c.

6476 — TRANSVAAL — Government Prospecting for Tin in the Transvaal. U. P. Swinburne. (N. Z. Mines Rec., Mar. 16, 1908; 1½ pp.) Describes the work of the Government prospecting party and the country in which it is working. 40c.

TIN

6477—WASHINGTON—Tin Ore at Spokane, Wash. Arthur J. Collier. (U. S. Geol. Surv. Bull. No. 340-D; 1908; 11 pp.) The geography, topography and geology of the district around Silver Hill, southeast of Spokane, where discoveries of tin ore were reported during 1907.

TUNGSTEN

6478—NEVADA—Tungsten Deposits in the Snake Range, White Pine County, Eastern Nevada. F. B. Weeks, (U. S. Geol. Surv. Bull No. 340-D; 1908; 8 pp.) Discusses the development of this locality and the character and occurrence of the ore deposition.

6479—STEEL HARDENING—Die seltenen Metalle, Kobalt, Vanadium, Molybdän, Titan, Uran, Wolfram und ihre Bedeutung für die Technik unter beonderer Berücksichtigung der Stahlindustrie. A. Haenig. (Oest. Zeit. f. B. u. H., May 2, 1908; 3 pp.) This is one of a series of articles dealing with the sources of ore supplies, and the physical effect of the metal upon steel. 40c.

ZINC

6480—CALAMINE DEPOSITS of Southwest Missouri. Otto Ruhl. (Min. Wld., May 16, 1908; 2¼ pp.) Discusses the important deposits near Granby and Aurora, and others less important, describing the orebodies and the mining and milling methods.

6480a—FOUST JIG—First Practical Application of the Foust Jig. Doss Brittain. (Eng. and Min. Journ., May 30, 1908; 1¾ pp.) Describes an installation in the Joplin district where a new jig is used instead of the Cooley type; illustrated. 20c.

6481—METALLURGICAL CALCULATIONS—The Metallurgy of Zinc.—II. J. W. Richards. (Electrochem. and Met. Ind., May, 1908; 4 pp.) This number treats of the reduction of zinc oxide to the metal and solves two interesting problems. 40c.

6482—METALLURGY—Recent Advances in the Metallurgy of Zinc. Woolsey McA. Johnson. (Journ. Frank. Inst., Mar., 1908; 12 pp.) Considers first the peculiarities of the reduction of zinc, oxide to the metal and then takes up the improvement which has been made in recent years in the concentration and reduction of zinc ores generally. 60c.

6483—MILLING—The American Mill at Oronogo, Joplin District. Doss Brittain. (Eng. and Min. Journ., May 23, 1908; 3 pp.) Describes a typical plant for concentrating sheet-ground ore, but differing in some essential details from practice prevailing at Joplin; illustrated. 20c.

6484—MILLING METHODS in the Kansas-Missouri Zinc Fields. Doss Brittain. (Min. Sci., Apr. 30, 1908; 1½ pp.) Description of methods, with a short account of the evolution from small imperfect mills to large modern plants; illustrated. 20c.

6485—MINING COSTS in the Joplin District. Doss Brittain. (Min. and Sci. Press, Apr. 18, 1908; 1 p.) A summary of the costs of mining and milling in the Joplin district, which is of interest in view of the recent low prices in the spelter market. 20c.

6486—ROYALTY—Sliding-Scale Royalty. Louis D. Huntoon. (Mines and Minerals, May, 1908; 1½ pp.) Sets forth the proposed system of royalty to obviate the disadvantages of the present system in the Missouri zinc region. 20c.

6487—ZINC RETORTS and Refractory Crucibles. A New Method of Construction. (Iron and Coal Tr. Rev., May 1, 1908; 1¼ pp.) Describes a new system of constructing the retorts or muffle used in connection with zinc distillation furnaces; illustrated. 40c.

ECONOMIC GEOLOGY—GENERAL

6488—ASHOKAN DAM—Quality of Bluestone in the Vicinity of the Ashokan Dam. Charles P. Berkey. (Sch. Mines Quart., Jan., 1908; 14 pp.) The geology and petrology of the rock formation in the vicinity of the Ashokan Dam, which will be constructed across Esopus creek, in the southern Catskills of New York. 60c.

6489—BRITISH COLUMBIA—The Correlation of the International Strata.—I. Horace F. Evans. (Min. Wld., May 16, 1908; 1½ pp.) The first of a series of papers on the system of correlation of strata in British Columbia with those of the State of Washington, especially those near the International boundary, which are supposed to belong to the same petrographic province. 20c.

6490a—CANADA—Work of the Geological Survey of Canada. (Eng. and Min. Journ., May 30, 1908; 1¾ pp.) Describes explorations in the newer districts of Canada; discusses the geology of the Yukon, of Cassair and other British Columbia districts and northern Quebec. 20c.

6490—CANADA—A Partial Bibliography of Publications Referring to the Geology and the Mineral Resources of Alberta, British Columbia, and the Yukon. J. C. Gwillim. (Can. Min. Journ., May 15, 1908; 1¾ pp.) Paper read before Can. Min. Inst., Ottawa meeting, 1908. A classification of literature dealing with the exploration, geology and mining of these regions. To be continued. 20c.

6491—GEOLOGY—J. F. Kemp. (Sch. Mines Quart., Jan. 1908; 24 pp.) The fifth of a series of lectures in the Course in Science Philosophy and Art, Columbia University, 1907-8; this lecture deals with the advance and growth of geology and points out some of the applications which have been made of it at different times in different parts of the world. 60c.

6492—ILLINOIS—Lower Paleozoic Stratigraphy of Southeastern Illinois. T. E. Savage. (Am. Journ. of Sci., May, 1908; 13 pp.) A preliminary statement concerning the pre-Mississippian formations that occur in the southwest portion of Illinois. 60c.

6493—MAGNETIC OBSERVATIONS in Geological and Economic Work. Henry L. Smyth. (Econ. Geol., Apr.-May, 1908; 19 pp.) Describes the Thalen-Tiberg magnetometer and tells how to make a magnetic survey with the instrument. 60c.

6494—MEXICO—Geology of the Sierra Almoloya. With Notes on the Tectonic History of the Mexican Plateau. Robert T. Hill. (Reprinted from *Science*, N. S., Vol. XXV, No. 664; 7 pp.) A general geological discussion of this district; contains a map of the State of Chihuahua. Read before the Geological Section of the New York Academy of Sciences, Apr. 1, 1907.

6495—MINERAL VEINS—Character of Mineral Veins. Gordon Surr. (Am. Min. Rev., Apr. 25, 1908; 1 p.) Corrects some of the fallacies of prospectors concerning the formation of veins. 20c.

6496—NEVADA—A Tertiary River Channel Near Carson City, Nevada. John A. Read. (Min. and Sci. Press, Apr. 18, 1908; 3¾ pp.) Description of a well defined river channel on the East Slope of the Sierra Nevada; illustrated. 20c.

6497—PYRRHOTITIC PERIDOTITE from Knox County, Maine—A Sulphide Ore of Igneous Origin. E. S. Bastin. (Journ. of Geol., Feb., Mar., 1908; 15 pp.) Describes petrographs of this sulphide ore, which is of igneous origin. 60c.

6497a—WEST AUSTRALIA—Palæontological Contributions to the Geology of Western Australia. R. Etheridge, F. Chapman and W. Howchin. (West. Aus. Geol. Surv., Bull. No. 27; 1907; 71 pp.) A geological discussion which throws some light upon the geological age of the Collie river coal measures; accompanied by cuts and maps.

MINING—GENERAL

6498—AUSTRALIA—Papua Mining. I and II. J. H. P. Murray. (Aust. Min. Stand., Apr. 1 and 8, 1908; 3 pp.) Contains a general discussion of the geology and mining conditions of the district; also gives statistics of gold production and states the occurrence of other important minerals. 80c.

6499—BOREHOLES—Ein neuer Lotapparat für Bohrlöcher. K. Haussmann. (Glückauf, Feb. 15, 1908; 6 pp.) Describes construction and use of an instrument for surveying bareholes by which an automatic photographic record is obtained. 40c.

6500—BRAZIL—The Mining Industry in the State of Minas Geraes, Brazil. G. Campbell. (Min. Journ., Apr. 25 and May 2, 1908; 2 pp.) Discusses the history, mining laws and labor conditions of this district; also transportation, fuel and electricity, and describes some important mines. 60c.

6501—CONCRETE—Notes on the Use of Concrete in Mines. (Iron and Coal Tr. Rev., May 8, 1908; 1 p.) Gives the reasons why concrete is favorably regarded for mining work and tells of some of the uses to which it is being put. Reproduced from *Concrete and Constructional Engineering*. 40c.

6502 — CONVEYING OF MATERIAL. (Chem. Engr., Apr., 1908; 13 pp.) Describes many of the methods and appliances now in use for conveying materials at mines, mills and manufacturing works. To be continued. 40c.

6503—CONVEYER SYSTEM at the New Kleinfontein Mill. Edward J. Way. (Eng. and Min. Journ., May 2, 1908; 4¾ pp.) Describes how belts, some working on curves, others supported from towers or mounted on turntables, handle coal, ore, ashes and waste; illustrated. 20c.

6504—DIVING, With Special Reference to Mines. J. S. Haldane. (Iron and Coal Tr. Rev., Apr. 10, 1908; 2¾ pp.) An interesting paper on this subject which presents at times a great problem to the mining engineer. 40c.

6505 — DRAINAGE TUNNELS — Custom Tunnels for Drainage and Transportation of Ore. (Eng. and Min. Journ., Apr. 25, 1908; ¾ p.) Gives the reasons for the failure of the scheme for transportation and drainage by tunnels in the State of Colorado. 20c.

6506—GERMANY—Mineral Production of Germany. (Eng. and Min. Journ., May 9, 1908; ¾ p.) Contains statistics of production during the years 1906 and 1907 of coal and iron, metallic ores, metals and by-products, and potash and other salts. Translated from *Glückauf*. 20c.

6507—HAULAGE—Main and Tail Rope Haulage. George Farmer. (Sci. and Art of Min., May 16, 1908; 1½ pp.) Discusses electricity as applied to main and tail rope haulage. 20c.

6508—HOISTING AND HAULAGE at the North Star Mine. W. H. Spaulding. (Eng. and Min. Journ., May 2, 1908; 1 p.) Describes the hoisting equipment and methods in use at this deep mine; illustrated. 20c.

6509—INDIA'S MINERAL PRODUCTION. (Eng. and Min. Journ., May 23, 1908; ½ p.) Reports the total value of minerals for which returns of production are available for the years 1905 and 1906, with a review of mining operations. 20c.

6510—MINE ACCOUNTS—Notes on the Audit of a Mining Company. Alexander Aiken. (So. Afr. Min. Journ., Apr. 25, 1908; 2 pp.) Deal chiefly with certain items of every audit which are imperative. 20c.

6511—MINE DUMPS—Sampling of Mine Dumps. Henry S. Munroe. (Sch. Mines Quart., Apr., 1908; 5 pp.) A comprehensive discussion on this important subject, with practical illustrations of methods of sampling dumps; illustrated. 60c.

6512—MINE SUPPLIES—The Laboratory, Its Economic Value. A. McA. Johnston. (Journ. Chem., Feb., 1908; 2½ pp.) Discussion by A. Whitby and E. H. Croghan of the above paper which has been previously mentioned in this Index. 60c.

6513 — MINE VALUATIONS — Algernon Del Mar. (Eng. and Min. Journ., May 23, 1908; 1 p.) Sets forth the basis for calculation, and gives formulas with an explanation of their meaning. 20c.

6514—MINERS' WAGES—The Incidence of Methods of Payment on the Efficiency of Mines. K. Austin. (Journ. Chem., Met. and Min. Soc. of So. Africa, Feb., 1908; 2 pp.) Discussion by A. Richardson of the above paper which has been previously mentioned in this Index. 60c.

6515—MINING COSTS—Variations in Mining Costs. John B. Hastings. (Min. and Sci. Press, Mar. 28, 1908; 3¾ pp.) A thorough consideration of the various items of cost in connection with mining operations. 20c.

6516—MINING LAW—Short Talks on Mining Law—I. A. H. Ricketts. (Eng. and Min. Journ., May 9, 1908; 1½ pp.) Discusses the United States mining laws with respect to placer and lode location, sets forth what constitutes a discovery, distinguishes between mineral and agricultural land, and states what land is subject to location. 20c.

6517—MINING LAW—Short Talks on Mining Law—II. A. H. Ricketts. (Eng. and Min. Journ., May 23, 1908; 1½ pp.) Continuation of this subject, taking up the forfeiture of right to a mining location, the process of "advertising out" of partners, the notice of location, value of the record, and the patent. 20c.

6518—MINING LAW—The Rights of the Miner. Theo. F. Van Wagenen. (Min. and Sci. Press, May 16, 1908; 4¾ pp.) Discusses the mining industry and the relation thereto of the prospector, the miner, the engineer and the investor. 20c.

6519—NATURAL RESOURCES—Conservation of Ores and Minerals. Andrew Carnegie. (Eng. and Min. Journ., May 23, 1908; 2 pp.) Takes up the wasteful use of the country's supply of coal, iron ore and other minerals, and suggests methods of delaying their exhaustion. 20c.

6520—NEW YORK—Mineral Production of New York. D. H. Newland. (Eng. and Min. Journ., May 16, 1908; 1¼ pp.) A general review of the mineral industry of New York during 1907, discussing industrial conditions and giving the output and value of the ores and materials produced. 20c.

6521—NEW ZEALAND—The Mining Industry of New Zealand. (N. Z. Mines Rec., Mar. 16, 1908; 2 pp.) Contains abstracts from the census reports of New Zealand for 1906. 40c.

6522—NOVA SCOTIA—Report on the Mines of Nova Scotia. Hiram Donkin. (Halifax, N. S.; 1908; Commissioner of Public Works and Mines, 150 pp.) Contains an account of the progress of mining operations, together with statistical information compiled from official and other returns.

6523—OREGON—Mining in Northeast Oregon. (Northwest Min. News, Mar., 1908; 1⅓ pp.) Discusses the mining industry in general and gives the names and locations of the important districts: illustrated. 20c.

6524—PERU—The Mining Districts of Central Peru. J. C. Pickering. (Eng. and Min. Journ., May 16, 1908; 5 pp.) Describes mining and smelting operations at several camps within a comparatively short distance of Cerro de Pasco, where silver, copper, lead and coal are being produced; illustrated. 20c.

6526—PROBLEMS IN MINING—On Some Unsolved Problems in Metal-Mining. Henry Louis. (Engineer, May 1, 1908; 1½ pp.) James Forrest lecture, delivered before the Brit. Instn. Civ. Eng., Apr. 27, 1908. An interesting paper dealing with mining in general, prospecting, and the opening up of mineral deposits. 40c.

6527—QUEBEC—Mining Operations in the Province of Quebec for the Year 1907. J. Obalski. (Quebec, 1908: Dept. of Colonization, Mines and Fisheries; 61 pp.) Includes notes of a second exploration made in the unsurveyed region to the north of the county of Pontiac and the usual information on the different mining industries of the province; accompanied by three maps.

6528—REFRIGERATION — Application of Refrigeration to Mining Work. Jos. H. Hart. (Min. Wld., May 9, 1908; 1 1/3 pp.) Describes various processes of mechanical refrigeration and discusses its application to sinking in loose or wet ground. 20c.

6529—ROAD MAKING—The Use of the Split Log Drag on Earth Roads. D. Ward King. (U. S. Dept. of Agriculture, Farmer's Bull. 321; Apr., 1908; 14 pp.) Contains information of practical value on the construction and use of split-log road drags.

6530—SHAFT SINKING—Collar at No. 1 Allan Shaft. H. E. Coll. (Can. Min. Journ., May 15, 1908; 2 pp.) Paper read before the Min. Soc. of Nova Scotia, Mar. 25, 1908. Describes the operations in connection with the sinking of the shaft through a considerable thickness of water-bearing sand overlaid with clay. 20c.

6531—SHAFT SINKING—Difficulties and Dangers Encountered in Sinking Through Running Ground, Whether Wet or Dry. W. H. Storms. (Am. Min. Rev., May 9 and 16, 1908; 2½ pp.) Sets forth the dangers and difficulties encountered in sinking through running ground, whether wet or dry, and describes the use of the bridge. 40c.

6532—SHAFT SINKING—Note sur le Foncage du Puits de Sancy. Gaston Beuret.

(Bull. de la Soc. de l'Ind. Minérale, livr. 2, 1908; 70 pp.) Describes in considerable detail the method pursued in sinking this shaft, in which suspended, electrically-driven, centrifugal pumps were used. 80c.

6533—SHAFT SINKING—Sinking a Concrete-Lined Mine Shaft. (Eng. Rec., May 16, 1908; 1 p.) Describes the sinking of a mine shaft, consisting of an open concrete caisson, through 79 ft. of water-bearing soil overlying bed rock. 20c.

6534—SOUTH AMERICA—Spanish-American Mines. (Mex. Min. Journ., May, 1908; 2½ pp.) Goes into general conditions with respect to mining in Colombia and Peru; mentions some unworked fields and comments on their accessibility and development. 20c.

6535—STOPING WITHOUT TIMBERS. Mark Ehle, Jr. (Mines and Minerals, May, 1908; 1¾ pp.) Sets forth the method of mining at the Homestake mine, Lead, South Dakota, which is adapted for working large ore bodies; illustrated. 20c.

6536—TIMBERING Methods in Missouri-Kansas District. Otto Ruhl. (Min. Wld., May 2, 1908; 3⅛ pp.) Describes spilling, shaft cribbing, and other methods of timbering in this district; illustrated. 20c.

6537—TIMBERING—Mine Methods and Timbering. W. H. Storms. (Am. Min. Rev., Apr. 25, 1908; 1¼ pp.) Gives the preliminary arrangements and shows how the timbers of shaft sets are placed in position when delivered below. To be continued. 20c.

6538—UNDERGROUND TIMBERING—Holz und Eisen als Ausbaumaterial in Strecken- und Abbaubetrieben. Heinrich Steffen. (Stahl u. Eisen, April 1, 15 and 22, 1908; 17 pp.) Describes, with illustrations, the various methods of mine timbering, with special reference to the use of iron and steel pieces. $1.

6538a — UNWATERING — Reclaiming a Flooded Gypsum Mine. E. H. Fishack. (Eng. and Min. Journ., May 30, 1908; 1⅛ pp.) Describes a rather unusual method for unwatering a mine, employed by the Consumers Gypsum Company, at Port Clinton, O.; illustrated. 20c.

ORE DRESSING—GENERAL

6539—COMPLEX ORE TREATMENT—Montezuma Ore Test. William Koehler and James H. Myers. (Min. Sci., Apr. 23, 1908; 2½ pp.) Two interesting discussions in connection with the proper treatment of a complex sample of Montezuma ore. 20c.

6540—CONCENTRATING Mixed Ores at Rosas, Sardinia. Umberto Cappa. (Eng. and Min. Journ., May 9, 1908; 4¼ pp.) Goes into the separation of lead and zinc from mixed oxidized and sulphide ores by crushing in ball mills and washing over Ferraris tables; illustrated. 20c.

6541—MAGNETIC SEPARATION — An Electromagnet for Testing the Suitability of an Ore for Magnetic Separation. L. H. L. Huddart. (Eng. and Min. Journ., May 16, 1908; ½ p.) Abstract of a paper read before Brit. Instn. of Min. and Met. Describes an apparatus that has been found to be convenient for the determination of the separation to be expected in treating an ore, by means of powerful magnet; illustrated. 20c.

6542—SLIMES TREATMENT—The Concentration of Slimes. Edwin A. Sperry. (West. Chem. and Met., Apr., 1908; 9 pp.) Briefly reviews a preceding paper on this subject and takes up a few of the salient points brought out in it, for the purpose of more clearly demonstrating the vital necessity for proper preparation of the pulp before concentration should be attempted. 60c.

METALLURGY—GENERAL

6543—ALLOYS—Metallurgical Research at the National Physical Laboratory During 1907. (Electrochem. and Met. Ind., May, 1908; 2½ pp.) Gives the results of the investigations of the Alloys Research Committee of the Institution of Mechanical Engineers on the alloys of copper and aluminum and other series of aluminum alloys. 40c.

6544—COAL-DUST FIRING of Reverberatory Furnaces. E. A. Richmond. (Eng. and Min. Journ., May 16, 1908; 1 1/3 pp.) Comprehensive remarks by one who has had experience with coal-dust burning apparatus of many types. 20c.

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6547—ELECTROLYSIS — Direct Currents in Electrolysis Without Electrodes. Carl Hering. (Paper read before Am. Electrochem. Soc., Apr. 30, 1908; 12 pp.) Describes possible methods of producing a direct current in an electrolyte without electrodes.

6548—GASES—Tables and Constants. George C. Stone. (Sch. Mines Quart., Apr., 1908; 6 pp.) An interesting and useful series of tables showing the weights, weights of constituents, etc., of different gases. 60c.

6549—LIME KILNS—The Schmatolla System of Gas-Fired Lime-Kilns. (Engineering, Feb. 28, 1908; 1⅓ pp.) The construction and operation of this gas-fired vertical shaft kiln are described. 40c

6550—ORE CONTRACTS from a Producer's Point of View. Henry M. Adkinson. (Eng. and Min. Journ., May 16, 1908; 5 pp.) Tells how ore contracts are made, discusses treatment charges and the benefit of competition, and gives some results worked out from actual examples. 20c.

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MINING AND METALLURGICAL MACHINERY

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6560—HOISTING MACHINERY FOR THE HANDLING OF MATERIALS—III. T. Kennard Thomson. (Eng. Mag., May, 1908; 24 pp.) This number describes several styles of shovels, dredges and special unloaders; fully illustrated. 40c.

6560a—LUBRICATION—Economical Lubrication of Large Plants. W. M. Davis. (Journ. Assn. Eng. Soc., Apr., 1908; 21½ pp.) Considers the best methods and lubricants to be employed in the lubricating of a large plant so that the maximum efficiency and economy will be obtained. 40c.

6561—ORE HANDLING MACHINERY—I. Walter C. Stephan. (Iron Tr. Rev., May 14, 1908; 4½ pp.) Discusses ore handling machinery, in connection with the unloading of iron ores, and describes some of the new unloading machines; to be continued. 20c.

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6563—ROCK DRILL—Development of the Air-hammer Rock Drill. Claude T. Rice. (Eng. and Min. Journ., May 23, 1908; 1½ pp.) Sets forth the new features of the Kimber and the Flottman machines, which were tried in the recent stoping-drill contest in South Africa; illustrated. 20c.

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6565—STOPE DRILLS—Notes on Small Stope Drills (Journ. Chem., Met. and Min. Soc. of So. Africa, Mar., 1908; 7 pp.) Discussion by M. H. Coombe of E. M. Weston's article, which has been previously mentioned in this Index, together with the author's reply to same. 60c.

ANALYTICAL CHEMISTRY

6566—VOLUMETRIC IRON—Ueber den Einfluss der das Eisen begleitenden fremden Metalle auf die Eisentitration nach C. Rheinhardt. (Stahl u. Eisen, Apr. 8, 1908; 5 pp.) General results of tests to show the influence of copper, arsenic, chromium, nickel, cobalt, titanium, lead and antimony upon the Reinhardt vibration method for iron. 40c.

INDUSTRIAL CHEMISTRY

6567—SULPHURIC ACID—Die Zweiteilung der Gloverfunktionen. H. Schmidl. (Zeit. f. ange. Chem., Feb. 7, 1908; 3 pp.) A discussion of the savings that can be accomplished by a readjustment of the usual process for making sulphuric acid. 40c.

6568—SULPHURIC ACID—Impiego del Minerale di Solfo per la preparazione dell'acido solforico. (Rassegna Mineraria, May 1, 1908; 2½ pp.) A thorough discussion of the practicability of utilizing the crude Sicilian sulphur ore as a basis for the manufacture of sulphuric acid. 40c.

6569—SULPHURIC ACID FROM SICILIAN ORE—Verwendung der Sizilianischen Schwefelerze zur Schwefelsäurefabrikation. G. Oddo. (Chem.-Zeit., Feb. 12, 1908; 1½ pp.) Results of tests on a method whereby the Sicilian crude ores may be burned for sulphuric acid direct, to relieve the market stringency now threatening the island. 20c.

MATERIALS OF CONSTRUCTION

6570—BUILDING STONES—The Fire-Resisting Qualities of Some New Jersey Building Stones. W. E. McCourt. (Geol. Surv. of N. J., Annual Report of the State Geologist of N. J. for 1906, Part I; 77 pp.) Records tests in determining the fire-resisting qualities of some New Jersey building stones.

6571—CONCRETE—Proportions Used and Methods of Mixing Concrete. Leonard C. Wason. (Cement Age, Feb., 1908; 6 pp.) A paper before the Nat. Assn. of Cement Users, Jan., 1908. The strength of concrete mixed with different proportions of cement is discussed and then different methods of mixing concrete are described. 40c.

6572—CONCRETE—The Value of Sand in Concrete Construction. (Cement Age, Mar., 1908; ½ pp.) The value of different kinds of sand for concrete work is discussed and the results of a series of experiments on the strength of concrete made from different kinds of sand are given. 20c.

6573—PORTLAND CEMENT—The Influence of Gypsum and Chloride of Calcium on the setting of Portland Cement. R. C. Carpenter. (Eng. Digest, Apr., 1908; 3 pp.) Describes some experiments on the influence of gypsum and calcium chloride on the setting of portland cement. 40c.

6574—PORTLAND CEMENT MORTARS and Their Constituent Materials. Richard L. Humphrey and William Jordan. (U. S. Geol. Surv., Bull. No. 331, 1908; 130 pp.) Comprises results of tests made at the structural-materials testing laboratories, Forest Park, St. Louis, Mo., from 1905 to 1907.

Metal and Mining Companies—U. S.

Name of Company and Location.		Author-ized Capital	Shares. Issued.	Par Val.	Dividends. Total to Date.	Latest. Date.	Amt.
Alaska Mexican, g.	Al'ka	$1,000,000	180,000	$ 5	$1,896,381	Apr. 1908	$ .50
Alaska Treadwell,g.	Al'ka	5,000,000	200,000	25	9,935,000	Apr. 1908	.75
Alaska United, g.	Al'ka	1,000,000	180,200	5	333,370	Jan. 1908	.15
Amalgamated, c,.	Mont	155,000,000	1,530,879	100	56,718,304	May 1908	.50
Am.Sm.&Ref.,com.	U. S.	50,000,000	500,000	100	13,125,000	Apr. 1908	1.00
Am. Sm. & Ref. pf.	U. S.	50,000,000	500,000	100	27,088,053	Apr. 1908	1.75
Am. Smelters, pf. A	U. S.	17,000,000	170,000	100	2,705,000	June 1908	1.50
Am. Smelters. pf. B	U. S.	30,000,000	300,000	100	4,500,000	June 1908	1.25
Am. Zinc,Lead&Sm.	Kan.	3,750,000	80,000	25	280,000	Nov. 1907	.50
Anaconda,c.	Mont	30,000,000	1,200,000	25	39,650,000	Apr. 1908	.50
Arizona, c	Ariz	3,775,000	6,682,520	....	6,182,361	Apr. 1906	.05
Atlantic, c	Mich	2,500,000	100,000	25	990,000	Feb. 1905	.02
Bald Butte, g. s.	Mont	250,000	250,000	1	1,354,648	Oct. 1907	.04
Beck Tunnel, g.s.l.	Utah	100,000	1,000,000	0.10	675,000	Oct. 1907	.02
Bingham & N.H.,c.g	Utah	2,000,000	226,000	5	22,600	Sept. 1906	.10
Boston & Montana.	Mont	3,750,000	150,000	25	49,675,000	Apr. 1908	3.00
Bull.Beck.&Cham.g	Utah	1,000,000	100,000	10	2,688,400	Apr. 1907	.10
Bunker Hill & Sull.	Ida	3,000,000	300,000	10	10,146,000	May 1908	.25
Butte Coalition,c.s.	Mont	15,000,000	1,000,000	15	2,450,000	Dec. 1907	.15
Calumet & Arizonac	Ariz	2,500,000	200,000	10	9,500,000	Apr. 1908	1.00
Calumet & Hecla,c.	Mich	2,500,000	100,000	25	106,850,000	June 1908	5.00
Camp Bird, g., s.	Colo	5,500,000	820,000	5	5,229,673	Mar. 1908	.48
Carisa, c.g.	Utah	500,000	500,000	1	55,000	Nov. 1906	.01
Colorado, l. g. s	Utah	200,000	1,000,000	0.20	670,000	Jan. 1908	.05
Columbus Con. c.	Utah	1,500,000	283,540	5	226,832	Oct. 1907	.20
Combi'tion Co.G'f'd	Nevada	400,000	320,000	1	688,000	Sept. 1906	.15
Con. Mercur, g.	Utah	1,000,000	1,000,000	1	3,385,313	Dec. 1906	.02½
Continental, z. l.	Mo.	550,000	22,000	25	220,000	Oct. 1907	.50
Copper Range Con.	Mich	38,500,000	383,781	100	7,245,363	June 1908	1.00
Creede United, g.	Colo	2,000,000	1,625,000	1	214,053	July 1906	.00½
Daly Judge, g. s. l.	Utah	300,000	300,000	1	225,000	Apr. 1907	.37½
Daly West, g. s. l.	Utah	3,600,000	180,000	20	5,877,000	Dec. 1907	.30
De Lamar, g. s.	Ida	400,000	67,180	5	2,926,370	May 1905	.72
Dillon, g.	Colo	1,250,000	1,250,000	1	21,875	July 1905	.01
Doctor Jack Pot	Colo	3,000,000	3,000,000	1	277,000	June 1906	.00½
Doe Run, l.	Mo.	10,000,000	59,062	100	1,523,631	Mar. 1908	.50
Elkton Con., g.	Colo.	3,000,000	2,500,000	1	2,079,461	Apr. 1908	.01½
El Paso, g.	Colo.	2,500,000	2,450,000	1	1,022,750	June 1906	.01
Fed. Sm., com.	Idaho.	10,000,000	60,000	100	2,618,750	May 1908	1.50
Federal Sm., pf.	Idaho	20,000,000	120,000	100	3,701,250	May 1908	1.75
Findley, g.	Colo.	1,250,000	1,250,000	1	337,500	Sept. 1906	.01
Florence, g.	Nevada	1,250,000	1,050,000	1	210,000	Apr. 1908	.10
Frances-Mohawk,g	Nevada	1,000,000	910,000	1	410,000	Jan. 1908	.05
Gemini-Keystone	Utah	500,000	5,000	100	1,950,000	July 1907	10.00
Gold King Con.	Colo.	5,750,370	5,750,370	1	1,407,504	May 1905	.01
Goldfield Con., g.	Nevada	50,000,000	5,000,000	10	1,000,000	Nov. 1907	.10
Grand Central, g.	Utah	250,000	250,000	1	1,333,000	Oct. 1907	.05
Gwin Mine, Dev., g.	Cal	1,000,000	100,000	10	496,000	Apr. 1906	.05
Hecla, s. l.	Idaho	250,000	1,000,000	0.25	1,560,000	Apr. 1908	.01
Homestake, g.	S. D.	22,000,000	218,400	100	22,750,040	May 1908	.50
HornSilver,g.s.c.z.l	Utah	10,000,000	400,000	25	5,642,000	Sept. 1907	.05
Inter'l Nickel, pf.	N. Y.	12,000,000	89,126	100	1,336,890	May 1908	1.50
Iron Silver	Colo	10,000,000	500,000	20	4,100,000	Oct. 1907	.10
Jamison, g.	Cal	3,900,000	390,000	10	301,870	Apr. 1908	.02
Jerry Johnson	Cal	2,500,000	2,500,000	1	86,700	Jan. 1908	.01
Kendall, g.	Mont	2,500,000	500,000	5	1,205,000	Feb. 1908	.02
Liberty Bell,g. s.	Colo.	700,000	130,551	5	130,440	Jan. 1907	.15
Lightner, g.	Cal	125,000	102,255	1	253,081	Oct. 1906	.05
Lower Mammoth, g	Utah	190,000	190,000	1	42,750	Aug. 1907	.07½
Mammoth, g. s. l.	Utah	10,000,000	400,000	2.50	2,220,000	Mar. 1908	.05
Mary McKinney, g.	Colo.	1,500,000	1,304,252	1	801,765	Apr. 1907	.03
May Day, g. s. l.	Utah	800,000	800,000	1	70,010	Oct. 1907	.01½
Mohawk, c.	Mich	2,500,000	100,000	25	1,400,000	July 1907	5.00
Mont. Ore Purch.	Mont	2,500,000	80,833	25	9,437,274	Jan. 1907	15.00
Nevada Hills, s.g	Nevada	5,000,000	746,000	5	373,000	Dec. 1907	.10
New Century, z., l.	Mo.	300,000	300,000	1	230,300	Aug. 1907	.00½
Newhouse M. & S.c.	Utah	6,000,000	600,000	10	300,000	Sept. 1907	.50
New Idria, q.	Cal	500,000	100,000	5	990,000	Apr. 1908	.30
New Jersey Zinc	U. S.	10,000,000	100,000	100	12,000,000	May 1908	4.00
North Butte	Mont	6,000,000	400,000	15	5,600,000	June 1908	1.00
North Star, g.	Cal	2,500,000	250,000	10	1,599,489	Mar. 1908	.25
Old Dominion, c.	Ariz	8,750,000	293,245	25	574,088	Aug. 1907	1.00
OldDominion,M&Sc	Ariz	5,000,000	162,000	25	202,500	Aug. 1907	1.25
Old Gold	Colo	2,101,150	2,101,150	1	10,506	Mar. 1906	.05
Ophir, g. s.	Nevada	302,400	100,800	3	1,806,280	May 1908	.10
Osceola, c.	Mich	2,500,000	96,150	25	7,035,650	July 1907	7.00
Parrot, c,s.	Mont	2,300,000	229,850	10	6,807,649	Sept. 1907	.25
Pennsylvania, g.	Cal	5,150,000	51,500	100	284,925	July 1905	.10
Pitts. L. & Z., l.z.	Mo	1,000,000	1,000,000	1	20,000	July 1907	.02
Portland, g.	Colo.	3,000,000	3,000,000	1	7,876,080	Apr. 1908	.04
Quartette, g. s.	Nevada	1,000,000	100,000	10	375,000	July 1907	.20
Quincy, c	Mich	3,750,000	110,000	25	18,230,000	June 1908	1.00
Rocco Homest'k,l.s.	Nevada	300,000	300,000	1	112,000	Dec. 1905	.02
Sacramento, g. q.	Utah	1,000,000	1,000,000	1	258,000	Nov. 1906	.00½
St. Joseph, l.	Mo.	20,000,000	1,000,000	10	5,708,357	Mar. 1908	.15
Silver Hill, g. s.	Nevada	108,000	108,000	1	81,000	June 1907	.05
Silver King, g. s. l†	Utah	3,000,000	150,000	20	11,187,500	July 1907	.33½
Silver King Co't'n.†	Utah	6,250,000	1,224,425	5	367,410	Oct. 1907	.15
Shannon, c.	Ariz	3,000,000	300,000	10	450,000	July 1907	.50
Snowstorm, s. l.	Ida	1,500,000	1,500,000	1	450,000	Sept. 1907	.03
Standard Con., g. s.	Cal	2,000,000	178,394	10	5,158,452	Dec. 1907	.10
Stratton'sIndepend	Colo.	5,500,000	1,000,007	5	4,895,865	Apr. 1906	.12½
Swansea, g. s. l.	Utah	500,000	100,000	5	329,500	Mar. 1907	.05
Tamarack, c.	Mich	1,500,000	60,000	25	9,420,000	July 1907	4.00
Tennessee, c.	Tenn	5,000,000	200,000	25	1,806,250	Feb. 1908	1.25
Tomboy, g. s.	Colo.	1,750,000	300,000	5	900,000	June 1906	.48
Tonopah of Nev.	Nevada	1,000,000	1,000,000	1	3,500,000	Oct. 1907	.25
Tonopah Belmont.	Nevada	2,000,000	1,295,007	1	518,003	Apr. 1907	.10
Tonopah Ext'nsion	Nevada	1,000,000	928,433	1	283,030	Apr. 1906	.15
Tonopah Midway.	Nevada	1,000,000	1,000,000	1	250,000	Jan. 1907	.05
Uncle Sam, g.s.l.	Utah	500,000	500,000	1	200,000	Dec. 1907	.03
United States, com.	Utah	37,500,000	350,933	50	1,271,698	Apr. 1908	.50
United States, pfd.*	Utah	37,500,000	485,845	50	3,606,043	Apr. 1908	.87½
United Cop. com.	Mont	75,000,000	450,000	100	5,962,500	Aug. 1907	1.75
United, c. pf.	Mont	5,000,000	50,000	100	1,500,000	May 1907	3.00
United, z. l., pf.	Mo.-Kan.	500,000	19,556	25	312,782	Jan. 1908	.50
United Verde, c.	Ariz	3,000,000	300,000	10	19,935,322	Mar. 1908	.75
U.S. Red. & Ref. Pf.	Colo.	4,000,000	39,458	100	1,360,294	Oct. 1907	1.50
Utah, g.(Fish Sp'gs)	Utah	1,000,000	100,000	10	300,000	Apr. 1908	.03
Utah Con., c.	Utah	1,500,000	300,000	5	7,836,000	Apr. 1908	.50
Victoria, Utah	Utah	250,000	250,000	1	177,500	Mar. 1907	.04
Vindicator Con., g.	Colo.	1,500,000	1,500,000	1	1,830,000	Apr. 1908	.04
Wolverine, c.	Mich	1,500,000	60,000	25	4,800,000	Apr. 1908	5.00
Work, g.	Colo.	1,500,000	1,500,000	1	165,000	Apr. 1908	.01
YankeeCon.	Utah	500,000	500,000	1	157,500	Oct. 1907	.03
Yellow Aster, g.	Cal	1,000,000	100,000	10	958,789	Aug. 1907	.20

*Previous to consolidation $1,436,250 were divided. †Amalgamated.

Coal, Iron and Other Industrials—United States.

Name of Company and Location.		Author. Capital.	Shares. Issued	Par Val. $	Dividends. Total to Date.	Latest. Date.	Amt.
Ala. Con., C. & I., pf.	Ala.	$2,500,000	24,638	100	$905,265	May 1905	$1.75
Allis-Chalmers, pf.	U. S.	25,000,000	200,000	100	3,213,750	Feb. 1904	1.75
Amer. Ag. Chem., pf.	U. S.	20,000,000	181,530	100	9,002,752	Apr. 1908	3.00½
American Cement.	Pa.	2,000,000	200,000	10	1,168,000	Jan. 1908	.80
American Coal	Md	1,500,000	50,000	25	2,367,500	Sept. 1907	1.25
Associated Oil	Cal	21,000,000	21,000,000	1	630,000	Aug. 1905	.01
Bethlehem Steel, pf.	Pa.	15,000,000	150,000	100	900,000	Nov. 1906	.75
Cambria Steel	Pa.	50,000,000	900,000	50	9,337,500	Feb. 1908	.75
Caribou Oil	Cal	100,000	80,000	1	56,000	July 1905	.07
Central C. & C., com.	Mo	5,125,000	51,250	100	2,229,375	Apr. 1908	1.50
Central C. & C., pf.	Mo	1,875,000	18,750	100	1,359,378	Apr. 1908	1.25
Central Oil	W. Va.	1,500,000	60,000	25	182,500	May 1904	.25
Claremont Oil	Cal	500,000	450,000	1	58,500	June 1905	.01
Col. & Hock. C. & I.pf.	Ohio	7,000,000	69,244	100	383,818	Apr. 1908	1.50
Consolidated Coal	Ill.	5,000,000	50,000	100	350,000	July 1904	1.00
Consolidation Coal	Md	10,250,000	102,500	100	9,621,650	Jan. 1908	3.50
Crucible Steel, pf	Pa.	25,000,000	250,000	100	2,125,000	June 1907	1.50
Empire S. & I., pf.	N. J.	2,500,000	25,000	100	820,533	Jan. 1908	3.00
Fairmont Coal.	W. Va.	12,000,000	120,000	100	2,100,000	Jan. 1908	2.00
Four Oil	Cal	500,000	300,000	1	105,406	July 1905	.01
General Chem. com.	U. S.	12,500,000	74,103	100	2,115,640	June 1908	1.00
General Chem., pf.	U. S.	12,500,000	100,000	100	5,140,178	Apr. 1908	1.50
George's C'k Coal	Md.	2,500,000	22,000	100	1,188,000	July 1904	3.00
Imperial Oil	Cal	1,000,000	100,000	100	880,000	July 1905	.20
International Salt.	Penn.	30,000,000	182,280	100	927,060	Dec. 1906	1.00
Jeff. & Cl'f C. & I., com.	Pa.	1,500,000	15,000	100	330,000	Aug. 1905	5.00
Jeff. & Cl't. C. & I.,pf.	Pa.	1,500,000	15,000	100	938,000	Feb. 1908	2.50
Kern River Oil	Cal	2,000,000	20,000	100	39,500	May 1905	.18
Lehigh Coal & Nav.	Pa.	17,378,500	346,901	50	27,002,297	May 1908	2.00
Maryland Coal,pf.	Md	2,000,000	18,850	100	1,667,960	Jan. 1908	4.00
Monon R. Coal, pf.	Pa.	10,000,000	100,000	100	3,854,945	Jan. 1908	3.50
National Carbon, pf.	U. S.	4,500,000	45,000	100	2,047,500	May 1905	1.75
National Lead, com.	N. Y.	15,000,000	149,054	100	2,720,237	July 1908	1.25
National Lead, pf.	N. Y.	15,000,000	149,040	100	17,111,788	Mar. 1908	1.75
Nat'l Steel & Wire,pf.	N. Y.	5,000,000	25,778	100	631,561	May 1906	1.75
New Central Coal	Md.	1,000,000	50,000	20	350,000	May 1907	.40
New River Coal, pfd.	W. Va.	4,000,000	37,617	100	225,702	Nov. 1907	1.50
Pacific Coast Borax.	Cal.	2,000,000	19,000	100	2,086,500	Aug. 1905	1.00
Peerless Oil	Cal	1,000,000	92,000	10	396,320	May 1905	.14
Penna. Salt	Pa.	3,000,000	60,000	50	14,918,000	Apr. 1908	3.00
Penna. Steel, pfd.	Pa.	25,000,000	168,214	100	8,204,493	Nov. 1907	3.50
Phila. Gas, com	Pa.	28,953,029	579,061	50	8,484,336	Nov. 1907	.75
Phila. Gas, pf.	Pa.	6,000,000	120,000	50	2,700,000	Mar. 1908	1.25
Pittsburg Coal, pf.	Pa.	32,000,000	297,010	100	11,434,962	Apr. 1905	1.75
Pocahontas Coll., pf.†	W. Va.	2,800,000	28,000	100	84,000	Jan. 1908	3.00
Pocahontas Coll.,cm†	W. Va.	4,520,000	45,200	100	135,600	Oct. 1907	3.00
Republic I. & S., pfd.	Ill.	25,000,000	204,169	100	6,045,338	Apr. 1908	1.75
Sloss-Sheffield, com.	Ala.	10,000,000	100,000	100	1,625,009	Mar. 1908	1.25
Sloss-Sheffield, pf.	Ala.	10,000,000	67,000	100	3,634,750	July 1908	1.75
Standard Oil	U. S.	100,000,000	970,000	100	614,002,905	June 1908	9.00
Tenn. C. & I., com	Tenn.	22,553,600	225,536	100	3,583,060	Nov. 1907	1.00
Tenn. C. & I., pf.	Tenn.	248,000	2,480	100	390,040	Nov. 1907	2.00
Texas & Pacific Coal.	Texas	2,500,000	23,940	100	1,663,830	Dec. 1908	1.50
United Metals Selling	U. S.	5,000,000	50,000	100	5,125,000	Apr. 1908	5.00
U. S. SteelCorp.,cm.,	U. S.	550,000,000	5,083,025	100	73,666,079	June 1908	.50
U. S. Steel Corp., pf.	U. S.	360,281,100	3,603,141	100	206,371,215	May 1908	1.75
Va. Carolina Ch., pf.	U. S.	20,000,000	180,000	100	13,260,869	Apr. 1908	2.00
Warwick I. & S.	U. S.	1,500,000	145,581	1	473,138	Nov. 1907	.30
Westmoreland Coal.	Pa.	3,000,000	60,000	50	8,730,000	Apr. 1908	2.50

Canada, Mexico, Central and South America.

Name of Company and Location.		Author-ized Capital.	Shares. Issued.	Par Val. $	Dividends. Total to Date.	Latest. Date.	Amt.
Amistad y Conc'rdia.	Mex.	$480,000	9,600	50	$258,064	Jan. 1905	$1.71
Batopilas	Mex.	9,000,000	446,268	20	† 55,784	Dec. 1907	.12½
British Columbia, c.	B. C.	3,000,000	503,000	5	201,200	Sept. 1907	.40
Buffalo, s	Ont.	1,000,000	900,000	100	189,000	Apr. 1902	.08
Butters' Salvador, g.	Salv.	750,000	150,000	5	600,000	Apr. 1905	.25
Coniagas (Cobalt)	Ont.	4,000,000	800,000	5	600,000	May 1908	.10
Consolidated M & S.	B. C.	5,500,000	53,552	100	781,885	Nov. 1907	1.25
Crow's Nest Pass	B. C.	4,000,000	160,000	25	2,018,648	July 1907	.62½
Dominion Coal, com.	N. S.	15,000,000	150,000	100	2,850,000	July 1908	1.00
Dominion Coal, pf.	N. S.	3,000,000	30,000	100	‡630,000	Feb. 1908	3.50
Dos Estrellas, g. s.	Mex	150,000	3,000	50	1,020,555	July 1905	13.65
El Oro, g. s.	Mex	5,750,000	1,080,000	5	4,600,800	Jan. 1908	.36
Esperanza, s.	Mex	2,275,000	455,000	5	8,426,150	Apr. 1908	1.09
Foster Cobalt, s.	Ont.	1,000,000	1,000,000	1	50,000	Jan. 1907	.05
Granby Con.	B. C.	15,000,000	135,000	100	2,968,630	Sept. 1907	3.00
Greene Con. Copper.	Mex	8,640,000	864,000	10	6,137,800	Mar. 1907	.40
Greene Con. Gold.	Mex	5,000,000	500,000	10	300,000	July 1905	.20
GreenGold-Silv'r,pfd.	Mex	3,000,000	300,000	10	120,000	Mar. 1907	.40
Guanajuato	Mex	3,000,000	540,000	5	74,250	Oct. 1906	.07
Guggenheim Expl.	Mex	17,000,000	105,000	100	4,222,500	Apr. 1908	2.50
Hinds Con., g.s.c.l.	Mex	5,000,000	5,000,000	1	100,000	Feb. 1908	.02
Kerr Lake, s.	Ont.	3,000,000	600,000	5	570,000	Apr. 1908	.15
LeRoi No. 2, g.	B. C.	3,000,000	120,000	25	774,000	Mar. 1908	.48
McKinley-Darragh,s.	Ont.	2,500,000	2,000,000	1	180,000	Jan. 1908	.04
Mexican Coal & Coke	Mex.	5,000,000	50,000	100	600,000	Dec. 1905	3.00
Mex. Con. M. & S. Co.	Mex	2,500,000	240,000	10	660,000	Mar. 1908	.25
Mines Co. of Am.	Mex.	2,000,000	2,000,000	1	3,025,000	Mar. 1908	.02
N. Y. & Hond. Ros.	C. A.	1,500,000	150,000	10	2,712,000	May 1908	.10
Nipissing, s.	Ont.	6,000,000	1,200,000	5	1,680,000	Apr. 1908	.15
North Star.	B. C.	1,500,000	1,300,000	1	351,000	Dec. 1904	1.00
N. S. St. & Coal, com.	N. S.	5,000,000	49,876	100	1,087,856	Apr. 1908	1.50
N. S. St. & Coal, pf.	N. S.	1,030,000	10,300	100	437,750	Apr. 1908	2.00
Penolee*	Mex.	250,000	2,500	100	8,630,000	Dec. 1907	20.00
Platanillo	Mex.	500,000	206,989	1	5,580	Sept. 1906	.00
Reco, g. s.l.	B. C.	1,000,000	958,000	1	327,082	Apr. 1906	.02
Silver Queen, s.	Ont.	1,500,000	1,500,000	1	195,000	May 1908	.05
Slocan Star.	B. C.	500,000	500,000	1	575,000	Dec. 1904	.05
Tezuitlan Copper	Mex	1,000,000	10,000	100		Apr. 1908	1.50
Tilt Cove, c.	N. F.	1,000,000	89,000	2	21,360	Jan. 1905	.48
Tretheway, s.	Ont.	1,000,000	1,000,000	1	80,000	Mar. 1907	.04
Tyee, c	B. C.	940,000	180,000	5	136,800	Dec. 1904	.24

*Mexican Currency. †Since reorganization. ‡Since August, 1905.

Construction News

Antelope Valley—The Home Gold Mining Company is preparing to put up a mill. A. W. Collins, Tropico, Kern county, Cal., is manager.

Lac Du Bonnet, Manitoba—The reconstruction of the Inter-west Peat Company's factory, which was burned down last fall, has commenced, and the company expects the plant to be in operation by July. The factory will be of corrugated iron over a wooden frame. When completed the plant will cost $25,000, and its capacity will be 100 tons of peat blocks daily, though it is not expected to manufacture more than 25 tons per day this season.

Industrial

The John A. Traylor Machinery Company, Denver, Colo., removed its offices to 1401-9 Blake street on June 1.

Warren Wood, proprietor of the Wood Drill Works, Paterson, N. J., has left for a short business trip to the Chicago offices of the concern.

Stillwell & Gladding have removed their offices and laboratories to their permanent building, 181 Front street (near Fulton street), New York.

The Lake Superior Iron and Chemical Company has closed down its furnace and plant at Elk Rapids, Mich., giving as a reason the low price of iron and slack demand. It is not expected that the furnace will go into blast before August, after repairs are made.

The Arthur Koppel Company, manufacturer of industrial and portable railway, is erecting an extension to its plant at Koppel, Penn., which will be devoted to the manufacture of portable tracks of special design. The addition is being built with concrete base and corrugated siding over steel frame.

The William J. Oliver Manufacturing Company, Knoxville, Tenn., mining and contractors' equipments, has under construction a new erecting shop, 80x220 ft., and is providing other improvements to its plant, including the remodeling of its power plant, installing conveying machinery for heavy products, etc.

The Allis-Chalmers Company has opened an office at Birmingham, Alabama, in charge of Seldon Jones, as district manager, rooms 319-320 First National Bank building. Inquiries regarding the varied line of machinery manufactured by the company will be promptly attended to at this address.

The Moore Filter Company advise us that they have closed a contract with the San Rafael mine, of Pachuca, Mexico, of which Señor Edmundo Girault is manager, and J. B. Empson, consulting engineer, for a type A filter plant of a daily capacity of 250 tons. It is proposed to double the capacity of this plant just as soon as the first unit is in operation.

A meeting was held in Cincinnati recently of representatives of the blast furnaces of Southern Ohio and of the railroads carrying coke from Pennsylvania and West Virginia into that district, with a view to obtaining a reduction in the present rates of freight on coke. The railroads declined to make any concession in the rates and the meeting adjourned with nothing accomplished.

The American Spiral Pipe Works have removed their New York offices from 39 Cortlandt street, to larger and better equipped offices in the Hudson Terminal buildings, 50 Church street. New York. Mr. F. B. Sanborn is in charge, and is prepared to furnish complete information and prices of "Taylor's Spiral Riveted Pipe" for hydraulic mining, exhaust steam and all other water supply work.

The demand for electric motors in general power application appears to be a pretty good barometer of business activity in all fields just now. Judging from the recent influx of orders for Allis-Chalmers motors of various sizes and for various applications, it would seem that producers are not content to await the settlement of political issues before fortifying themselves against the increased demand for manufactured products which the future will inevitably bring.

A good example of how the development of one industry helps another is found in an order for manganese steel disks recently placed by the Cutler-Hammer Clutch Company, of Milwaukee. This company, in addition to manufacturing magnetic clutches, makes a specialty of lifting magnets for handling pig iron and scrap metal. The 50-inch magnets recently furnished by the Cutler-Hammer Clutch Company to a number of steel mills in the Pittsburg district are all equipped with manganese steel coil shields instead of with the brass coil shields formerly used.

H. W. Caldwell & Son Company, Chicago, Ill., recently produced a cut gear and pinion of unusual size to be used in connection with the drive of a mining hoist in the Lake Superior copper mines. The gears are of a semi-steel mixture and the weight of the large gear is 13,200 pounds and of the small gear 8100 pounds. The pitch diameter of the large gear is 95.51 inches and of the pinion 55.41 inches. Width of face 27 inches, pitch 3 inches. The gears were cast in halves and the joints planed. The dimensions of the gears are unusual on account of the small pitch as compared with the wide face. The teeth were machined in a large gear planer, it being considered preferable to plane the teeth, rather than mill them on account of the extraordinary dimensions of the gears.

The general offices and sales departments of Fairbanks, Morse and Company, formerly at the corner of Franklin and Monroe streets, moved during the month of April and are now located in their new buildings with offices at the corner of Wabash avenue and Eldredge Place, Chicago. This is the home office of the company. The new office building is a seven-story structure, with basement, fronting 165 feet on Eldredge Place and 43 feet on Wabash avenue. The new warehouse is a five-story brick structure 100 feet by 100 feet, with track facilities on Sangamon street, and alley on the opposite side with wagon shed. The main entrance is on 19th street. The warehouse capacity has been very much increased, as it is the intention to carry much larger stocks than heretofore, which will enable the company to make shipments promptly and otherwise handle their fast-growing business to better advantage. Fairbanks, Morse and Company also report that their branch houses at Denver, Omaha and San Francisco have recently moved into new buildings and that their Los Angeles house will move into a new building within a few months.

The Kerr Turbine Company, of Wellsville, N. Y., is busy in spite of dull times executing orders as follows: Two 60-h.p. Kerr steam turbines coupled to No. 8 Sturtevant gas blowers for the Economical Gas Apparatus Construction Company, at Aberdeen, Scotland; ten single-stage Kerr steam turbines with disc fans for forced draft work for the Lathrop Engineering Company, New York; one 10-kw. turbine generator set, direct current, with brake testing outfit for the Agricultural and Mechanical College of Mississippi; one 4-h.p. single stage turbine for driving blower for the Buffalo Forge Company for service in Mexico; one 15-kw. direct current Kerr-Sterling generator set for C. Deuterman and Sons, White Plains, N. Y.; one 150-kw. Kerr-Westinghouse d.c. unit for Janeway and Carpender, New Brunswick, N. J.; one 100-k.v.a. Kerr-Burke turbine alternator for the Warren Manufacturing Company, Milford, N. J.; one 85-h.p. Kerr steam turbine for the Sirocco Engineering Company, New York, to drive Sirocco blowers for forced draft at the New York Edison Waterside Station; four 200-h.p. Kerr steam turbines to drive centrifugal pumps for the Wheeler Condenser and Engineering Company, New York City; one 1200-gal. Kerr-Worthington turbine pump unit, head 470 ft., for the Mississippi River Commission, Vicksburg, Miss;. a 1-kw. headlight turbine generator unit for Chas. M. Lewis and Company, of Evansville, Ind.; one 60-h.p. turbine to drive centrifugal pump for the Dayton Hydraulic Machinery Company, of Dayton, O. Reports from the engineering salesmen in the larger commercial centers as well as the inquiries coming direct to the home office indicate a rapid and real improvement in business conditions.

Trade Catalogs

Buffalo Pitts Company, Buffalo, N. Y. Catalog. Traction Engines. Pp. 48, illustrated, paper, 7½x9½ in.

Eureka Drill Steel Company, 1416-1418 Wazee street, Denver, Colo. Circular. It's All in the Lugs. Illustrated.

Box Electric Drill Company, 115 Broadway, New York. Bulletin No. 201. Electric rock drill. Pp. 8, illustrated, 6x9 in.

Wright Manufacturing Company, Detroit, Mich. Catalog No. 11. Steam Specialties. Pp. 44, illustrated, paper, 6x9 in.

Crocker-Wheeler Company, Ampere, N. J. Bulletin No. 101. Form D motors and generators. Pp. 8, illustrated, 7½x10 in.

Atlas Car and Manufacturing Company, Cleveland, Ohio. Catalog. Mine and Ore Cars. Pp. 102, illustrated, paper, 6x9 in.

Way's Pocket Smelter Company, South Pasadena, Cal. Booklet. The Prospector's Friend. Pp. 36, illustrated, paper, 3½x6 in.

Broderick & Bascom Rope Company, St. Louis, Mo. Catalog. Underground wire rope haulage. Illustrated, paper, 9½x12 in.

L. S. Pierce, 1650 Champa street, Denver, Colo. Catalog. Pierce Gold Separator and Amalgamator. Pp. 13, illustrated, paper, 3½x6 in.

The Gardner Electric Drill and Machinery Company, Cleveland, Ohio. Bulletins. Adams Electrically-driven Rock Drill. Illustrated.

New York Engineering Company, 2 Rector street, New York. Catalog. Dredges and Gold Dredging. Pp. 32, illustrated, paper, 6x9 in.

Oil Well Supply Company, Pittsburg, Penn. Catalog No. 21 A. Well drilling machinery and tools. Pp. 368, illustrated, cloth, 6x9 in.

The Western Lubricating Valve Company, 1416-1418 Wazee street, Denver, Colo. Catalog. Lubricating valve. Pp. 18, illustrated, paper, 5x7 in.

American-La France Fire Engine Company, Elmira, N. Y. Catalog. Chemical Engines for Mines and Railroads. Pp. 20, illustrated, paper, 6½x8 in.

F. W. Braun, Los Angeles and San Francisco. Catalog R. Assayers and Chemical Laboratory Apparatus and Supplies. Pp. 484, illustrated, paper, 6½x10 in.

Eugene Dietzgen Company, 214-220 East 23d street, New York. Catalog. Drawing materials and surveying instruments. Pp. 474, illustrated paper, 5½x8½ in.

C. L. Berger & Sons, 37 William street, Boston, Mass. Hand Book and Illustrated Catalog. Engineers and surveyors' instruments. Pp. 210, paper, 6x9 in.

The Cleveland Pneumatic Tool Company, Cleveland, Ohio. Catalog H. Pneumatic Hammers, Drills, etc. Pp. 36, illustrated, paper, 6x9 in. Bulletin No. 10. Cleveland Air Hammer Drills. Pp. 16, illustrated, paper, 6x9 in.